Nokia Customer Care

Service Manual

RM-396 (Nokia 6212 classic; L3&4)
Mobile Terminal
Part No: (Issue 1)

COMPANY CONFIDENTIAL

NOKIA
Care

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	8/2008	LB	

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IMPORTANT

This document is intended for use by qualified service personnel only.

Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or WCDMA PA may be damaged.

For your safety

QUALIFIED SERVICE

Only qualified personnel may install or repair phone equipment.

ACCESSORIES AND BATTERIES

Use only approved accessories and batteries. Do not connect incompatible products.

CONNECTING TO OTHER DEVICES

When connecting to any other device, read its user's guide for detailed safety instructions. Do not connect incompatible products.

Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

Battery information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Li-Ion batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77° F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

Company Policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

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Nokia 6212 classic; L3&4 Service Manual Structure

1 General information
2 Service Devices and Service Concepts
3 BB Troubleshooting and Manual Tuning Guide
4 RF troubleshooting
5 System Module Description
Glossary

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1 — General information

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Table of Contents

Product selection........1–5
Phone features........1–5
User interface and software features........1–6
Accessories........1–6
Supported NFC tag types........1–8
Technical specifications........1–8
- Main RF characteristics for GSM850/900/1800/1900 and WCDMA V (850) and WCDMA I (2100) phones........1–8
- General specifications........1–9
- Battery endurance........1–10
- Environmental conditions........1–10

List of Tables

Table 1 Battery and chargers........1–7
Table 2 Car accessories........1–7
Table 3 Headsets........1–7
Table 4 Data cables........1–7
Table 5 Memory cards........1–7
Table 6 Supported NFC tag types........1–8

List of Figures

Figure 1 RM-396 (Nokia 6212 classic) product picture........1–5

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Product selection

RM-396 (Nokia 6212 classic) is a GSM/WCDMA dual mode phone, supporting EGSM850/900/1800/1900 and WCDMA850/2100.

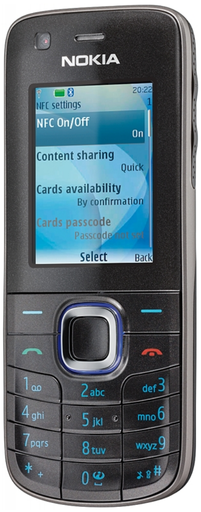
NOKIA
NFC settings
NFC On/Off
On
Content sharing
Quick
Cards availability
By confirmation
Cards passcode
Select
Back

Figure 1 RM-396 (Nokia 6212 classic) product picture

Phone features

Special feature

- Contactless payment and ticketing using Near Field Communication (NFC)

Display and keypad features

- 2.0” 240x320 pixel, 16M true colour display
- 5-way scroll, two soft keys, send and end keys
- Side volume keys with the zoom functionality

Hardware features

- Integrated NFC modem and NFC antenna
- Secure element: Global Platform 2.1.1 compliant Java smart card with 72KB EEPROM, supporting card emulation for ISO 14443 Type A and Mifare 4K cards
- 2.0 megapixel camera with flash, 8x digital zoom, landscape mode
- Secondary camera for video calls
- Micro USB port for data transfer (USB 2.0)
- 2.5 mm AV connector
- Bluetooth version 2.0
- Internal vibrator and antenna
- 24 MB user memory
- Hot swap microSD card slot
- Stereo FM radio and Music Player

RF features

- GSM/EGSM: 850/900/1800/1900

- WCDMA: 850/2100 (band V + I)
- EGPRS: MSC 32
- GPRS: MSC 32
- CSD

User interface and software features

Selection of software applications and services

- Nokia Xpress audio messaging (AMS)
- Flight mode
- Video streaming and recording
- Video telephony
- Themes (wallpapers, icons, colors)
- Music Player supporting MP3, MP4, AAC, eAAC+ and Windows Media Player
- OMA DRM 2.0 (Digital Right Management)
- OMA MMS 1.2, MMS Conformance 3.0, AMR and SMIL
- OMA Client Provisioning v1.1
- OMA IMPS
- Java
- 64 polyphonic ringing tones
- WAP 2.0
- XHTML browser over HTTP/TCP/IP stack
- SAIC
- SyncML (local and remote)
- Push to Talk
- Visual Radio
- Push e-mail client with attachment
- OTA download of ringing tones, themes, wallpapers
- FOTA - Firmware updates over the air
- SIM access profile in BT
- Nokia PC Suite

Accessories

Sales package contents

- Nokia 6212 classic phone
- Nokia Battery BL-4U
- Nokia Charger AC-3
- Nokia Wired headset HS-40
- NFC tags
- User Guide

Table 1 Battery and chargers

Type	Name
Note: This phone is charged through the smaller charger Nokia standard interface (2.0 mm plug). The 3.5 mm standard charger can be used together with the CA-44 charger adapter.	
BL-4U	Battery 1000 mAh Li-Ion
AC-3	Compact charger
AC-4	Travel charger
AC-5	Compact travel charger
CA-70	Charging connectivity cable

Table 2 Car accessories

Type	Name
HF-9W	Dashboard/sunvisor with display
HF-300	Speakerphone
CK-15W	Bluetooth display car kit
CR-82	Universal charging holder
HH-12	Holder easy mount

Table 3 Headsets

Type	Name
Wired	
HS-47	Stereo headset
Wireless	
BH-900	Bluetooth headset
BH-202	Bluetooth headset

Table 4 Data cables

Type	Name
CA-101	Micro USB cable

Table 5 Memory cards

Type	Name
MU-28	512 MB microSD card
MU-22	1 GB microSD card
MU-37	2 GB microSD card

Type	Name
MU-41	4 GB microSD card

Supported NFC tag types

This phone is compatible with non battery-powered (passive) tags.

> **Note:** Different tag/card implementations vary on antenna size and also on many electrical characteristics. Be prepared to test for interoperability with your selected tag implementation.

Table 6 Supported NFC tag types

NFC Forum tag types
NFC Forum Type 1 Tag Type 1 tag is based on ISO14443A. Tags are read and re-write capable; users can configure the tag to become read-only. Memory availability is 96 bytes and expandable to 2 kbyte; communication speed is 106 kbit/s.
NFC Forum Type 2 Tag Type 2 tag is based on ISO14443A. Tags are read and re-write capable; users can configure the tag to become read-only. Memory availability is 48 bytes and expandable to 2 kbyte; communication speed is 106 kbit/s.
NFC Forum Type 3 Tag Type 3 tag is based on the Japanese Industrial Standard (JIS) X 6319-4, also known as FeliCa. Tags are pre-configured at manufacture to be either read and re-writable, or read-only. Memory availability is variable, theoretical memory limit is 1MByte per service; communication speed is 212 kbit/s or 424 kbit/s.
NFC Forum Type 4 Tag Type 4 tag is fully compatible with ISO14443A and B standards. Tags are pre-configured at manufacture to be either read and re-writable, or read-only. Memory availability is variable, up to 32 KBytes per service; communication speed is up to 424 kbit/s.

Technical specifications

Main RF characteristics for GSM850/900/1800/1900 and WCDMA V (850) and WCDMA I (2100) phones

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900, WCDMA V (850) and WCDMA I (2100)
Rx frequency band	GSM850: 869 - 894 MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA V (850): 871 - 892 MHz
	WCDMA I (2100): 2110 - 2170 MHz

Parameter	Unit
Tx frequency band	GSM850: 824 - 849 MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA V (850): 826 - 847 MHz
	WCDMA I (2100): 1920 - 1980 MHz
Output power	GSM850: +5 ...+33dBm/3.2mW ... 2W
	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
	WCDMA V (850): -50 ... +24 dBm/0.01μW ... 251.2mW
	WCDMA I (2100): -50 ... +24 dBm/0.01μW ... 251.2mW
Number of RF channels	GSM850: 124
	GSM900: 174
	GSM1800: 374
	GSM1900: 299
	WCDMA V (850): 108
	WCDMA I (2100): 277
Channel spacing	200 kHz
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16
	WCDMA V (850): 75
	WCDMA I (2100): 75

General specifications

Unit	Dimension (mm)	Weight (g)	Volume (cc)
Transceiver with BL-4U 1000 mAh Li-Ion battery pack	114.5 x 47 x 13	95	70

Battery endurance

Battery	NMP Talk time	NMP Standby time
BL-4U 1000 mAh Li-ion	GSM up to 3h20min WCDMA up to 2h45min	GSM up to 300h WCDMA up to 300h

Note: Variation in operation times will occur depending on SIM card, network settings and usage.

Environmental conditions

Environmental condition	Ambient temperature	Notes
Normal operation	-15 ºC ... +55 ºC	Specifications fulfilled
Reduced performance	55 ºC ... +70 ºC	Operational only for short periods
Intermittent or no operation	-40 ºC ... -15 ºC and +70 ºC ... +85ºC	Operation not guaranteed but an attempt to operate will not damage the phone
No operation or storage	<-40 ºC and >+85 ºC	No storage. An attempt to operate may cause permanent damage
Charging allowed	-15 ºC ... +55 ºC	
Long term storage conditions	0 ºC ... +85 ºC	
Humidity and water resistance		Relative humidity range is 5 to 95%. Condensed or dripping water may cause intermittent malfunctions. Protection against dripping water has to be implemented in (enclosure) mechanics. Continuous dampness will cause permanent damage to the module.

2 — Service Devices and Service Concepts

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Table of Contents

Service devices 2–5
  Product specific devices 2–5
    FS-88 2–5
    MJ-184 2–5
    RJ-230 2–5
    SA-82 2–6
    SS-121 2–6
    SS-154 2–6
    SS-188 2–6
  General devices 2–6
    CU-4 2–7
    FLS-5 2–8
    FPS-10 2–8
    PK-1 2–8
    PKD-1 2–9
    RJ-215 2–9
    RJ-216 2–9
    SB-6 2–9
    SPS-2 2–9
    SRT-6 2–10
    SS-46 2–10
    SS-62 2–10
    SS-88 2–10
    SS-93 2–10
    ST-66 2–11
    ST-67 2–11
    SX-4 2–11
  Cables 2–11
    CA-101 2–11
    CA-35S 2–12
    PCS-1 2–12
    XCS-4 2–12
    XRE-2 2–13
    XRF-1 2–13
Service concepts 2–14
  POS (Point of Sale) flash concept 2–14
  Flash concept with FPS-10 2–15
  CU-4 flash concept with FPS-10 2–16
  Module jig service concept 2–17
  RF testing concept with RF coupler 2–18
  Service concept for RF testing and RF/BB tuning 2–19

List of Figures

Figure 2 POS flash concept 2–14
Figure 3 Basic flash concept with FPS-10 2–15
Figure 4 CU-4 flash concept with FPS-10 2–16
Figure 5 Module jig service concept 2–17
Figure 6 RF testing concept with RF coupler 2–18
Figure 7 Service concept for RF testing and RF/BB tuning 2–19

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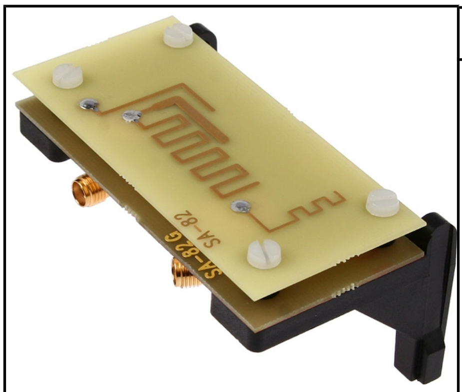
Service devices

Product specific devices

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-396. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

	FS-88	Flash adapter	
	• FS-88 is equipped with a clip interlock system • provides standardised interface towards Control Unit • provides RF connection using coupler • multiplexing between USB and FBUS media, controlled by VUSB		
	MJ-184	Module jig	
	MJ-184 is meant for component level troubleshooting. The jig includes an RF interface for GSM, WCDMA and Bluetooth. In addition, it has the following features: • Provides mechanical interface with the engine module • Provides galvanic connection to all needed test pads in module • Multiplexing between USB and FBUS media, controlled by Vusb • MMC interface • Duplicated SIM connector • Connector for control unit • Access for AV- and USB connectors		
	RJ-230	Soldering jig	
	RJ-230 is a soldering jig used for soldering and as a rework jig for the engine module.		

<table>
<tr><td rowspan="2"></td><td>SA-82</td><td>RF coupler</td><td></td></tr>
<tr><td colspan="3">SA-82 is an RF coupler for GSM and WCDMA RF testing. It is used together with SS-46 and SS-62.
The following table shows attenuations from the antenna pads of the mobile terminal to the SMA connectors of SA-82:
•
<table>
<tr><th>Frequency</th><th>Att. (dB)</th></tr>
<tr><td>GSM850 TX</td><td>Low: 12.28 Mid: 10.42 High: 10.54</td></tr>
<tr><td>GSM850 RX</td><td>Low: 7.7 Mid: 8.1 High: 6.7</td></tr>
<tr><td>GSM900 TX</td><td>Low: 7.72 Mid: 7.18 High: 7.72</td></tr>
<tr><td>GSM900 RX</td><td>Low: 6.3 Mid: 5.7 High: 5.3</td></tr>
<tr><td>GSM1800 TX</td><td>Low: 9.08 Mid: 9.3 High: 9.78</td></tr>
<tr><td>GSM1800 RX</td><td>Low: 9.1 Mid: 10.1 High: 10.9</td></tr>
<tr><td>GSM1900 TX</td><td>Low: 11.32 Mid: 10.74 High: 10.8</td></tr>
<tr><td>GSM1900 RX</td><td>Low: 9.1 Mid: 9.1 High: 9.1</td></tr>
<tr><td>WCDMA Band I TX</td><td>Low: 10.284 Mid: 10.43 High: 11.038</td></tr>
<tr><td>WCDMA Band I RX</td><td>Low: 8.3 Mid: 8.1 High: 8.3</td></tr>
<tr><td>WCDMA Band V TX</td><td>Low: 9.53 Mid: 9.01 High: 8.51</td></tr>
<tr><td>WCDMA Band V RX</td><td>Low: 9.9 Mid: 9.7 High: 8.7</td></tr>
</table></td></tr>
<tr><td rowspan="2"> </td><td>SS-121</td><td>NFC tags</td><td></td></tr>
<tr><td colspan="3">The package includes 4 pcs NFC 1K Ultra light tags.</td></tr>
<tr><td rowspan="2"> </td><td>SS-154</td><td>Domesheet tool</td><td></td></tr>
<tr><td colspan="3">The purpose of the domesheet tool SS-154 is to support the placement of a domesheet on the PWB.</td></tr>
<tr><td rowspan="2"></td><td>SS-188</td><td>IC breaking tool</td><td></td></tr>
<tr><td colspan="3">The purpose of the IC breaking tool SS-188 is to ....</td></tr>
</table>

General devices

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-396. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

CU-4

CU-4	Control unit	

CU-4 is a general service tool used with a module jig and/or a flash adapter. It requires an external 12 V power supply.

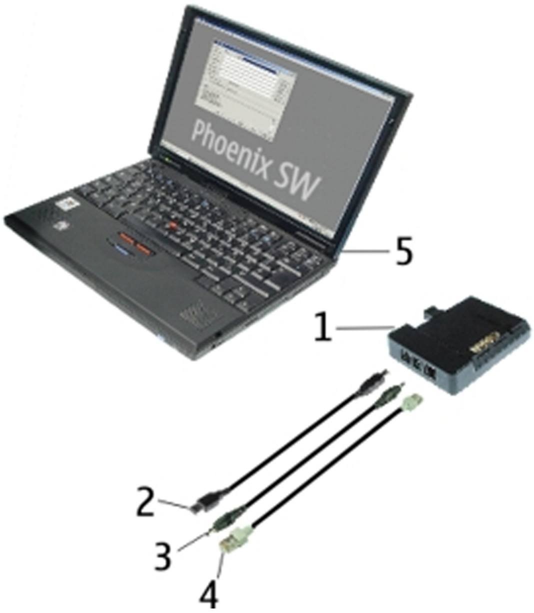
The unit has the following features:

- software controlled via USB
- EM calibration function
- Forwards FBUS/Flashbus traffic to/from terminal
- Forwards USB traffic to/from terminal
- software controlled BSI values
- regulated VBATT voltage
- 2 x USB2.0 connector (Hub)
- FBUS and USB connections supported

When using CU-4, note the special order of connecting cables and other service equipment:

Instructions

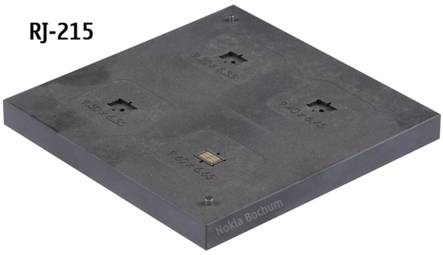
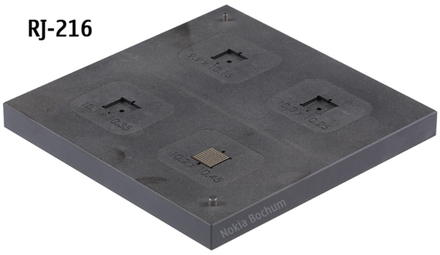
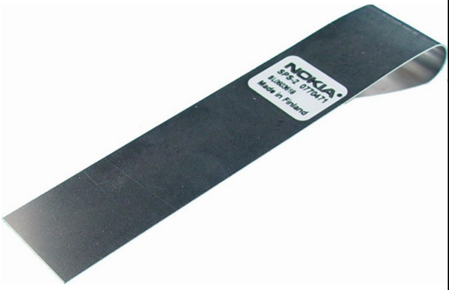
1. Connect a service tool (jig, flash adapter) to CU-4.
2. Connect CU-4 to your PC with a USB cable.
3. Connect supply voltage (12 V)
4. Connect an FBUS cable (if necessary).
5. Start Phoenix service software.

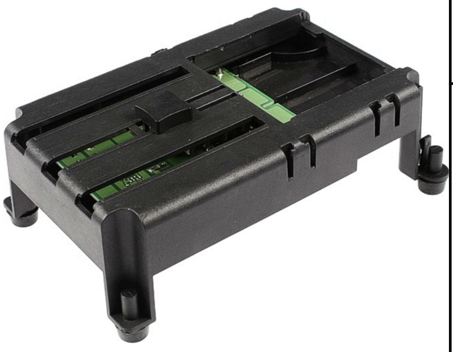
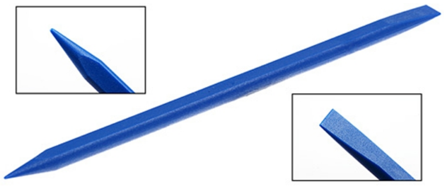


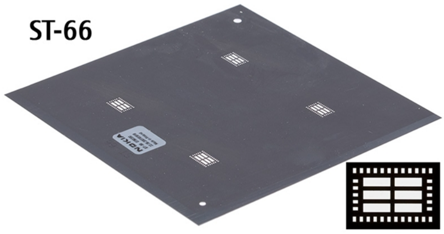
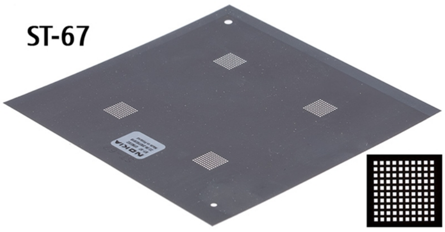
Note: Phoenix enables CU-4 regulators via USB when it is started.

Reconnecting the power supply requires a Phoenix restart.

	FLS-5	Flash device	
	FLS-5 is a dongle and flash device incorporated into one package, developed specifically for POS use. **Note:** FLS-5 can be used as an alternative to PKD-1.		
	FPS-10	Flash prommer	
	FPS-10 interfaces with: • PC • Control unit • Flash adapter • Smart card FPS-10 flash prommer features: • Flash functionality for BB5 and DCT-4 terminals • Smart Card reader for SX-2 or SX-4 • USB traffic forwarding • USB to FBUS/Flashbus conversion • LAN to FBUS/Flashbus and USB conversion • Vusb output switchable by PC command FPS-10 sales package includes: • FPS-10 prommer • Power Supply with 5 country specific cords • USB cable **Note:** FPS-21 is substitute FPS-10 if FPS-10 has not been set up.		
	PK-1	Software protection key	
	PK-1 is a hardware protection key with a USB interface. It has the same functionality as the PKD-1 series dongle. PK-1 is meant for use with a PC that does not have a series interface. To use this USB dongle for security service functions please register the dongle in the same way as the PKD-1 series dongle.		

<table>
<tr><td rowspan="2"> </td><td>PKD-1</td><td>SW security device</td><td></td></tr>
<tr><td colspan="3">SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC.
Without the device, it is not possible to use the service software.
Printer or any such device can be connected to the PC through the device if needed.</td></tr>
<tr><td rowspan="2">RJ-215
</td><td>RJ-215</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-215 is a jig used for soldering and as a rework jig for the engine module. It is used together with the ST-66 stencil.</td></tr>
<tr><td rowspan="2">RJ-216
</td><td>RJ-216</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-216 is a jig used for soldering and as a rework jig for the engine module. It is used together with the ST-67 stencil.</td></tr>
<tr><td rowspan="2"> </td><td>SB-6</td><td>Bluetooth tester</td><td></td></tr>
<tr><td colspan="3">The SB-6 test box is a generic device to perform Bluetooth bit error rate testing and doing cordless FBUS connection via Bluetooth.</td></tr>
<tr><td rowspan="2"></td><td>SPS-2</td><td>Soldering paste spreader</td><td></td></tr>
<tr><td colspan="3"></td></tr>
</table>

	SRT-6	Opening tool	SRT-6 is used to open phone covers.
	SS-46	Interface adapter	SS-46 acts as an interface adapter between the flash adapter and FPS-10.
	SS-62	Generic flash adapter base for BB5	• generic base for flash adapters and couplers • SS-62 equipped with a clip interlock system • provides standardised interface towards Control Unit • provides RF connection using galvanic connector or coupler • multiplexing between USB and FBUS media, controlled by VUSB
	SS-88	Camera removal tool	The camera removal tool SS-88 is used to remove/attach the front camera module from/to the socket.
	SS-93	Blue stick tool	SS-93 is used for general disassembly and assembly tasks.

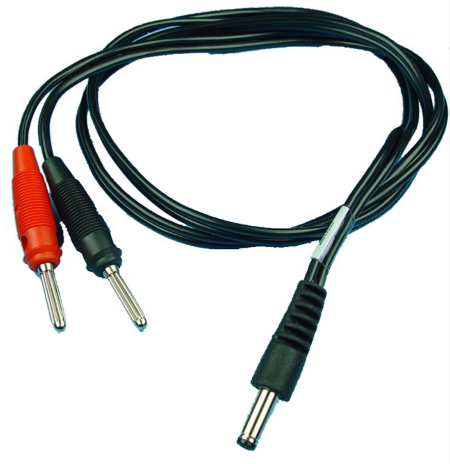
<table>
<tr><td rowspan="2">
</td><td>ST-66</td><td>Rework stencil</td><td></td></tr>
<tr><td colspan="3">ST-66 is a rework stencil used with rework jig RJ-215.</td></tr>
<tr><td rowspan="2">
</td><td>ST-67</td><td>Rework stencil</td><td></td></tr>
<tr><td colspan="3">ST-67 is a rework stencil used with rework jig RJ-216.</td></tr>
<tr><td rowspan="2">
</td><td>SX-4</td><td>Smart card</td><td></td></tr>
<tr><td colspan="3">SX-4 is a BB5 security device used to protect critical features in tuning and testing.
SX-4 is also needed together with FPS-10 when DCT-4 phones are flashed.</td></tr>
</table>

Cables

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-396. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

<table>
<tr><td rowspan="2">
CA-101
100cm

</td><td>CA-101</td><td>Micro USB cable</td><td></td></tr>
<tr><td colspan="3">The CA-101 is a USB-to-microUSB data cable that allows connections between the PC and the phone.</td></tr>
</table>

<table>
<tr><td rowspan="2"> </td><td>CA-35S</td><td>Power cable</td><td></td></tr>
<tr><td colspan="3">CA-35S is a power cable for connecting, for example, the FPS-10 flash prommer to the Point-Of-Sales (POS) flash adapter.</td></tr>
<tr><td rowspan="2"></td><td>PCS-1</td><td>Power cable</td><td></td></tr>
<tr><td colspan="3">The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled voltage.</td></tr>
<tr><td rowspan="2"> </td><td>XCS-4</td><td>Modular cable</td><td></td></tr>
<tr><td colspan="3">XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.</td></tr>
</table>

<table>
<tr><td rowspan="2"> </td><td>XRE-2</td><td>Bluetooth cable</td><td></td></tr>
<tr><td colspan="3">The bluetooth cable connects the bluetooth connector of the module jig to the bluetooth test box JBT-9.</td></tr>
<tr><td rowspan="2"> </td><td>XRF-1</td><td>RF cable</td><td></td></tr>
<tr><td colspan="3">The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment.
SMA to N-Connector ca. 610mm.
Attenuation for:
• GSM850/900: 0.3+-0.1 dB
• GSM1800/1900: 0.5+-0.1 dB
• WLAN: 0.6+-0.1dB</td></tr>
</table>

Service concepts

POS (Point of Sale) flash concept

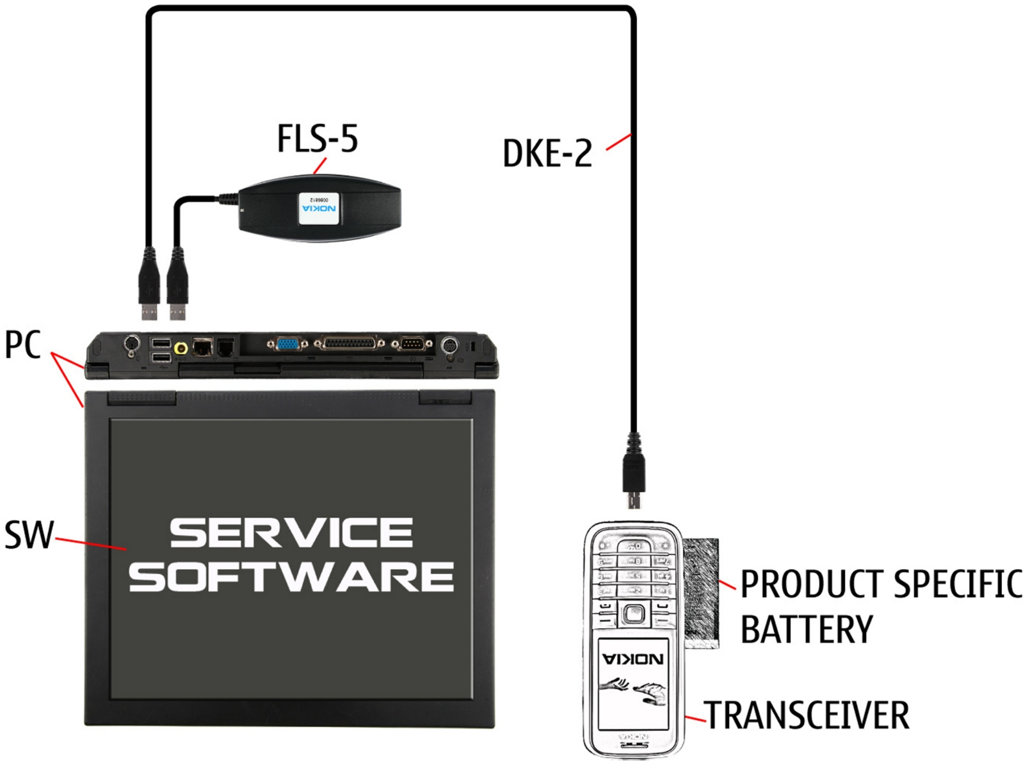

FLS-5
DKE-2
PC
SW
SERVICE SOFTWARE
PRODUCT SPECIFIC BATTERY
TRANSCEIVER

Figure 2 POS flash concept

Type	Description
Product specific tools	
BL-4U	Battery
Other tools	
FLS-5	POS flash dongle
	PC with Phoenix service software
Cables	
DKE-2	USB connectivity cable

Flash concept with FPS-10

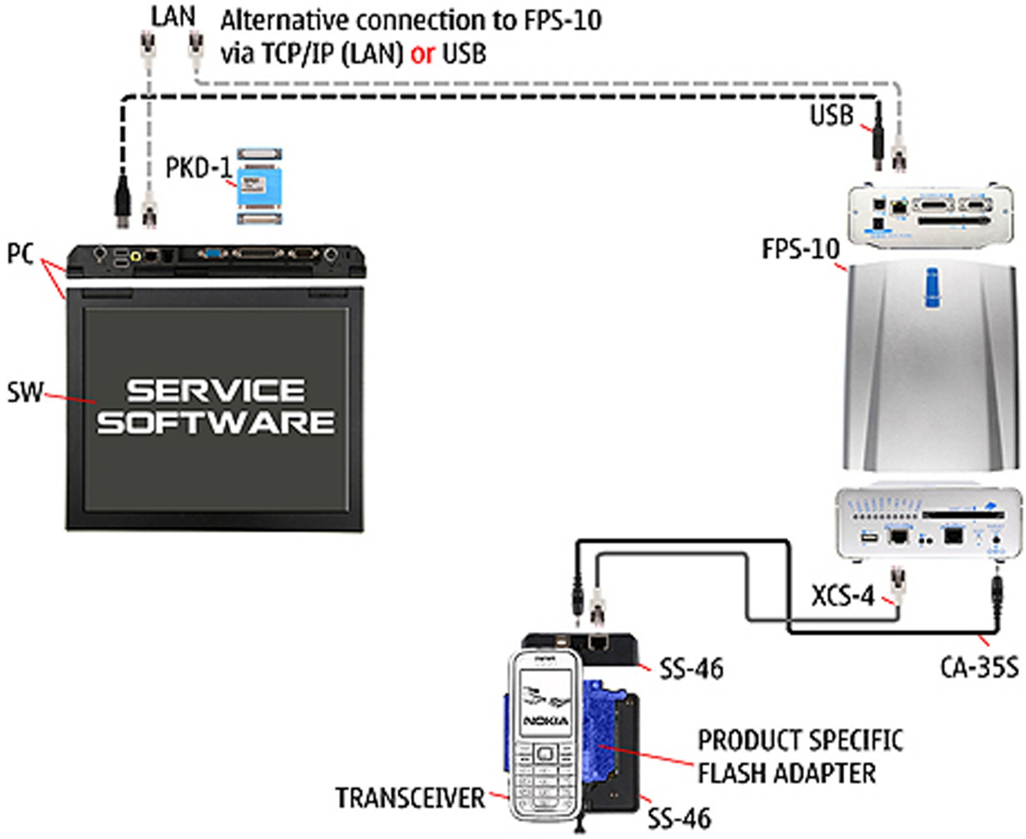

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
PKD-1
PC
FPS-10
SW
SERVICE
SOFTWARE
XCS-4
SS-46
CA-35S
PRODUCT SPECIFIC
FLASH ADAPTER
TRANSCEIVER
SS-46

Figure 3 Basic flash concept with FPS-10

Type	Description
Product specific devices	
FS-88	Flash adapter
Other devices	
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
CA-35S	Power cable
	USB cable

CU-4 flash concept with FPS-10

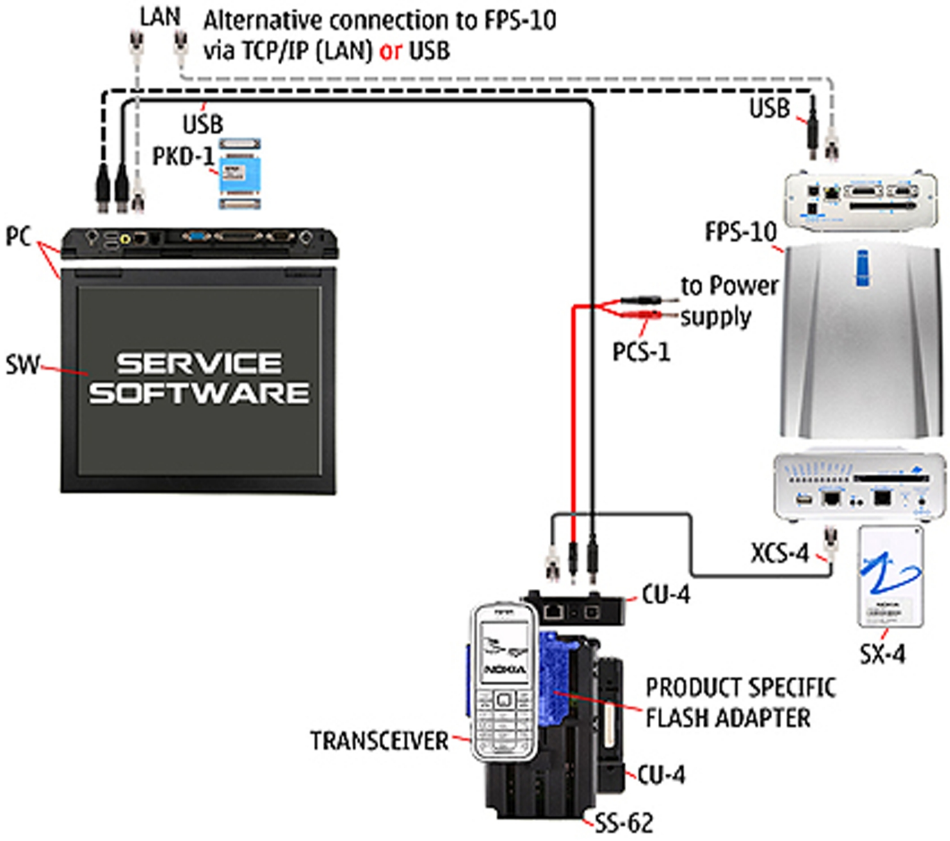

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
PKD-1
USB
PC
SW
SERVICE SOFTWARE
FPS-10
to Power supply
PCS-1
XCS-4
CU-4
SX-4
PRODUCT SPECIFIC FLASH ADAPTER
TRANSCEIVER
CU-4
SS-62

Figure 4 CU-4 flash concept with FPS-10

Type	Description
Product specific devices	
FS-88	Flash adapter
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
	Standard USB cable
	USB cable

Module jig service concept

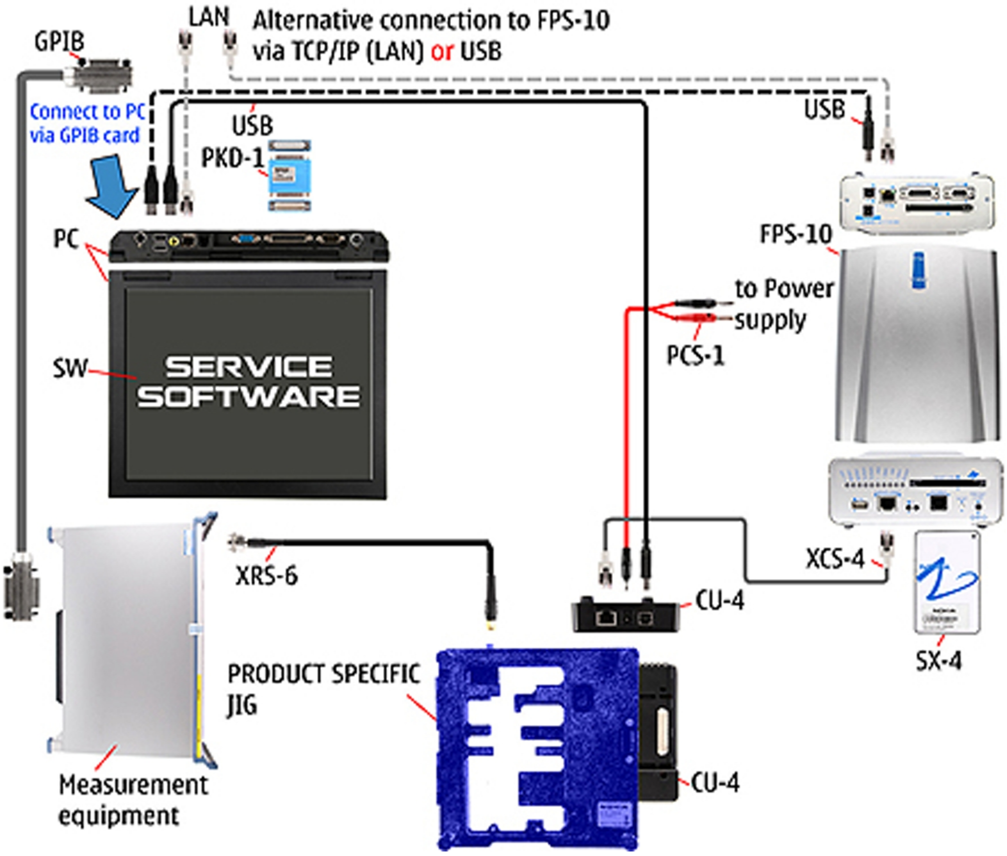

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
GPIB
Connect to PC via GPIB card
USB
PKD-1
USB
PC
FPS-10
to Power supply
PCS-1
SW
SERVICE SOFTWARE
XRS-6
XCS-4
CU-4
SX-4
PRODUCT SPECIFIC JIG
Measurement equipment
CU-4

Figure 5 Module jig service concept

Type	Description
Phone specific devices	
MJ-184	Module jig
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PK-1	SW security device
SX-4	Smart card
	PC with VPOS and Phoenix service software
	Measurement equipment
Cables	
PCS-1	DC power cable
XCS-4	Modular cable
XRF-1	RF cable
	USB cable

Type	Description
	GPIB control cable

RF testing concept with RF coupler

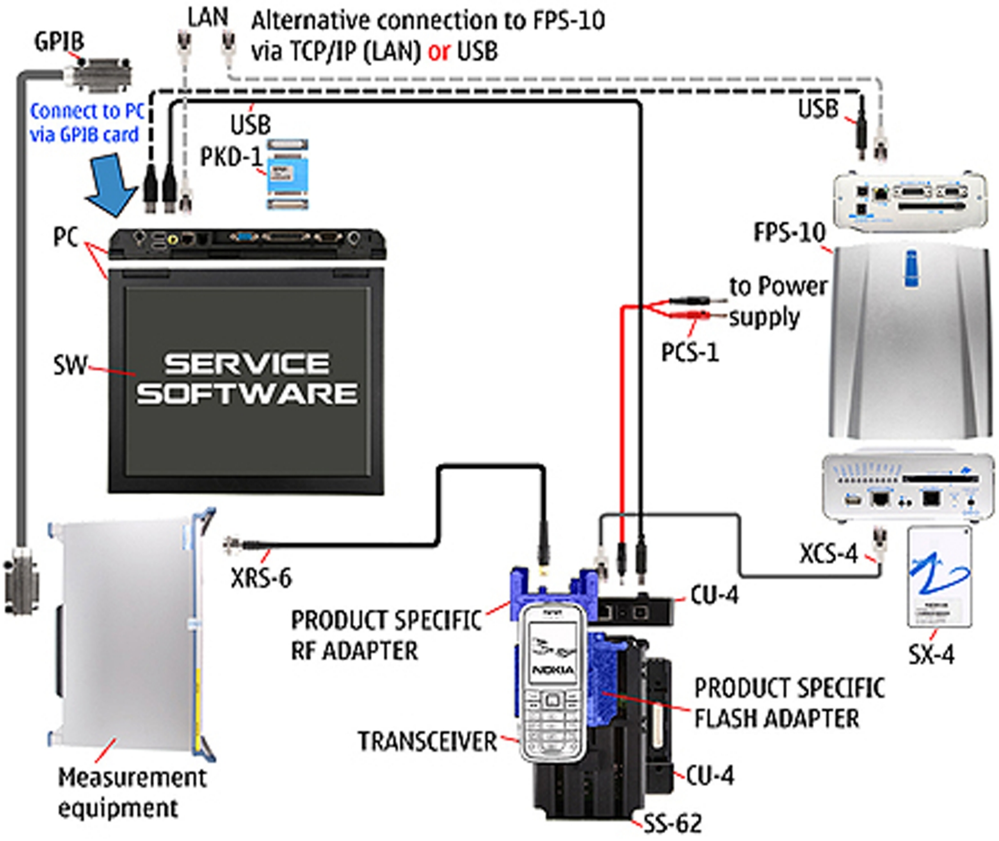

GPIB
LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
Connect to PC
via GPIB card
USB
PKD-1
USB
PC
FPS-10
to Power
supply
PCS-1
SW
SERVICE
SOFTWARE
XRS-6
XCS-4
CU-4
PRODUCT SPECIFIC
RF ADAPTER
SX-4
PRODUCT SPECIFIC
FLASH ADAPTER
TRANSCEIVER
CU-4
Measurement
equipment
SS-62

Figure 6 RF testing concept with RF coupler

Type	Description
Product specific devices	
FS-88	Flash adapter
SA-82	RF coupler
Other devices	
CU-4	Control unit
SX-4	Smart card
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
	Measurement equipment
	PC with Phoenix service software
Cables	
PCS-1	Power cable

Type	Description
XCS-4	Modular cable
XRS-6	RF cable
	GPIB control cable
	USB cable

Service concept for RF testing and RF/BB tuning

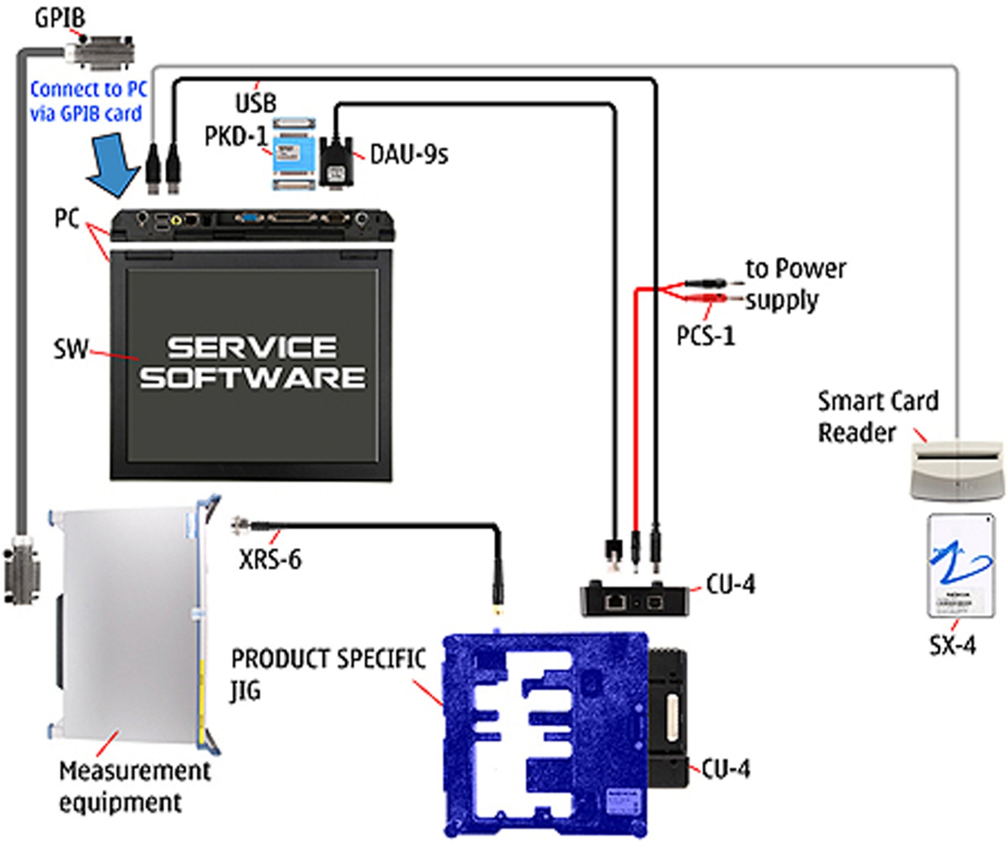

GPIB
Connect to PC via GPIB card
USB
PKD-1
DAU-9s
PC
SW
SERVICE SOFTWARE
to Power supply
PCS-1
Smart Card Reader
XRS-6
CU-4
SX-4
PRODUCT SPECIFIC JIG
CU-4
Measurement equipment

Figure 7 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
MJ-184	Module jig
Other devices	
CU-4	Control unit
PK-1	SW security device
SX-4	Smart card
	Measurement equipment
	Smart card reader
	PC with Phoenix service software

Type	Description
Cables	
DAU-9S	MBUS cable
PCS-1	DC power cable
XRS-6	RF cable
	GPIB control cable
	USB cable

3 — BB Troubleshooting and Manual Tuning Guide

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Table of Contents

Baseband self tests in Phoenix 3–5
Power and charging troubleshooting 3–7
    Dead or jammed device troubleshooting 3–7
    General power checking 3–9
    Charging troubleshooting 3–10
Interface troubleshooting 3–11
    Flash programming fault troubleshooting 3–11
    Combo memory troubleshooting 3–14
    SD card troubleshooting 3–14
    USB interface troubleshooting 3–15
    SIM card troubleshooting 3–16
User interface troubleshooting 3–18
    Keypad troubleshooting 3–18
    Power key troubleshooting 3–19
    Display module troubleshooting 3–19
        General instructions for display troubleshooting 3–19
        Blank display troubleshooting 3–21
        Faulty image troubleshooting 3–22
        Display on but no image troubleshooting 3–23
        Keyboard backlight troubleshooting 3–25
Camera module troubleshooting 3–25
    Introduction to camera troubleshooting 3–25
    Main (back) camera troubleshooting 3–25
        Taking and evaluating test pictures with main camera 3–25
        Main camera troubleshooting 3–27
        Main camera bad image quality troubleshooting 3–27
        Main camera viewfinder troubleshooting 3–29
        Main camera hardware failure message troubleshooting 3–30
        Main camera hardware troubleshooting 3–31
        Camera LED flash troubleshooting 3–31
    Secondary (front) camera troubleshooting 3–32
        Evaluating videocall picture quality from secondary camera 3–32
        Secondary camera bad image quality troubleshooting 3–34
        Secondary camera troubleshooting 3–34
        Secondary camera hardware troubleshooting 3–36
Audio troubleshooting 3–37
    Audio troubleshooting test instructions 3–37
    Internal earpiece troubleshooting 3–41
    Internal microphone troubleshooting 3–41
    Internal handsfree (IHF) troubleshooting 3–42
    External microphone troubleshooting 3–43
    External earpiece troubleshooting 3–44
    Acoustics troubleshooting 3–45
        Introduction to acoustics troubleshooting 3–45
        Earpiece troubleshooting 3–46
        IHF troubleshooting 3–47
        Microphone troubleshooting 3–48
    Vibra troubleshooting 3–49
NFC troubleshooting 3–49
    Introduction to NFC troubleshooting 3–49

NFC troubleshooting for service........ 3–49
NFC troubleshooting for repair analysis 3–53
Baseband manual tuning guide........ 3–54
Certificate restoring for BB5 products........ 3–54
Energy management calibration 3–60

List of Tables

Table 7 Display module troubleshooting cases........ 3–20
Table 8 Pixel defects 3–20
Table 9 Calibration value limits 3–60

List of Figures

Figure 8 Flashing pic 1. Take single trig measurement for the rise of the BSI signal. 3–12
Figure 9 Flashing pic 2. Take single trig measurement for the rise of the BSI signal. 3–13
Figure 10 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected. 3–39
Figure 11 Differential output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected. 3–39
Figure 12 Single-ended output waveform of the HP_in_Ext_out loop when microphone is connected.... 3–40
Figure 13 NFC tag detection 3–50
Figure 14 NFC selftest in Phoenix 3–50
Figure 15 NFC board connector soldering........ 3–52
Figure 16 NFC troubleshooting testpoints........ 3–54

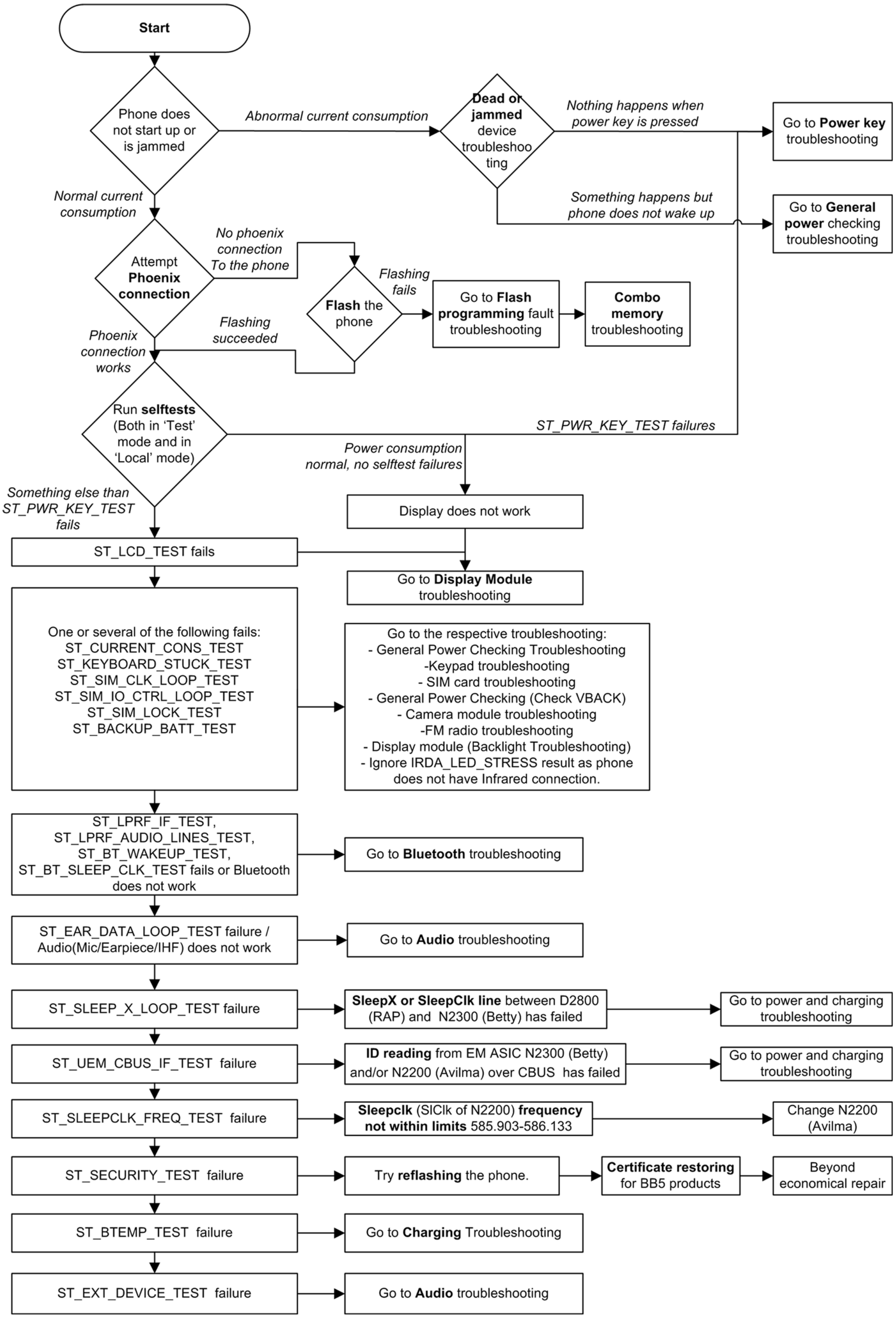
Baseband self tests in Phoenix

Context

Always start the troubleshooting procedure by running the Phoenix self tests. If a test fails, please follow the diagram below.

If the phone is dead and you cannot perform the self tests, go to *Dead or jammed device troubleshooting.*

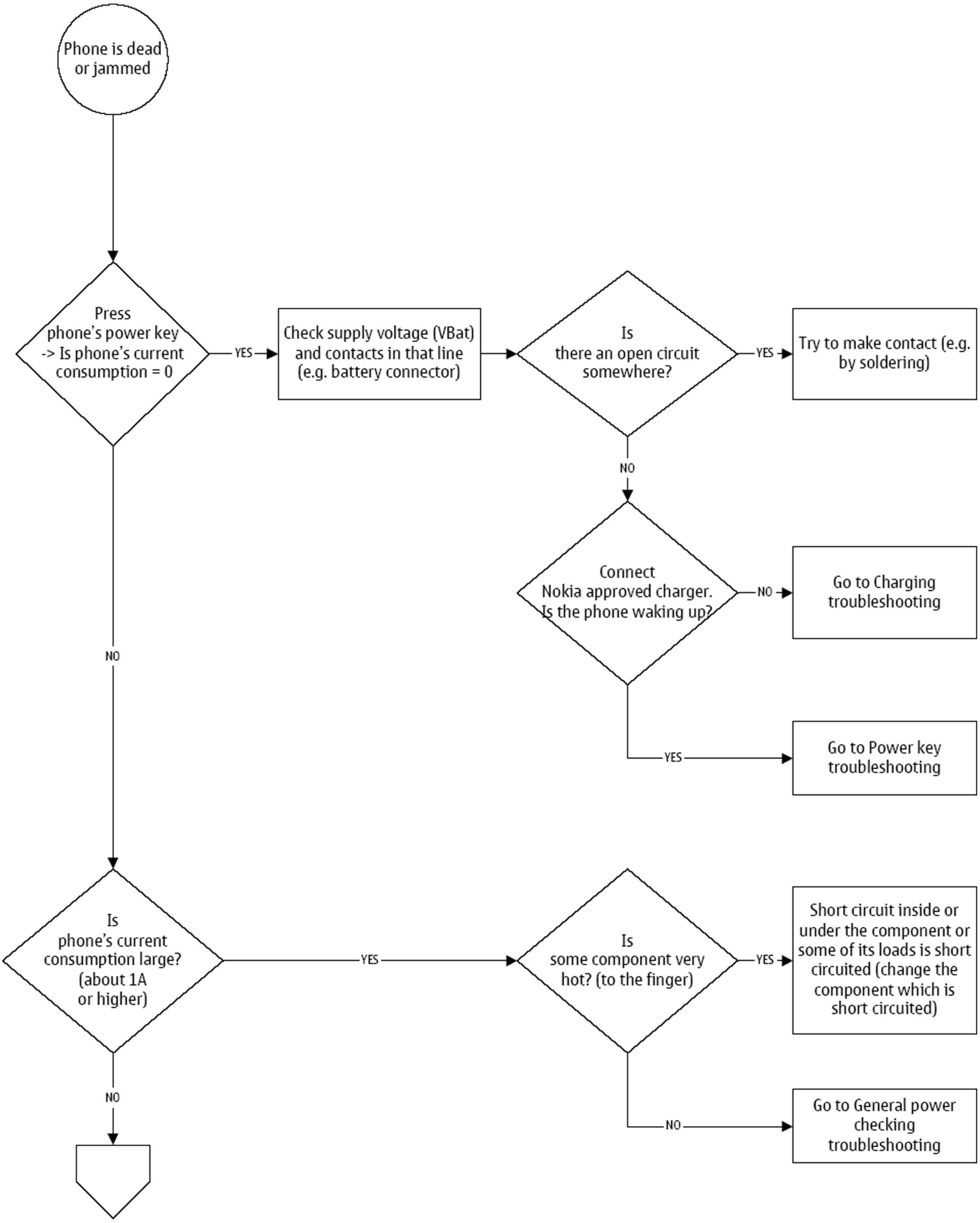
Troubleshooting flow


Start
Phone does not start up or is jammed
Abnormal current consumption
Dead or jammed device troubleshooting
Nothing happens when power key is pressed
Go to Power key troubleshooting
Something happens but phone does not wake up
Go to General power checking troubleshooting
Normal current consumption
Attempt Phoenix connection
No phoenix connection To the phone
Flash the phone
Flashing fails
Go to Flash programming fault troubleshooting
Combo memory troubleshooting
Flashing succeeded
Phoenix connection works
Run selftests (Both in 'Test' mode and in 'Local' mode)
ST_PWR_KEY_TEST failures
Power consumption normal, no selftest failures
Display does not work
Something else than ST_PWR_KEY_TEST fails
ST_LCD_TEST fails
Go to Display Module troubleshooting
One or several of the following fails: ST_CURRENT_CONS_TEST ST_KEYBOARD_STUCK_TEST ST_SIM_CLK_LOOP_TEST ST_SIM_IO_CTRL_LOOP_TEST ST_SIM_LOCK_TEST ST_BACKUP_BATT_TEST
Go to the respective troubleshooting: - General Power Checking Troubleshooting -Keypad troubleshooting - SIM card troubleshooting - General Power Checking (Check VBACK) - Camera module troubleshooting -FM radio troubleshooting - Display module (Backlight Troubleshooting) - Ignore IRDA_LED_STRESS result as phone does not have Infrared connection.
ST_LPRF_IF_TEST, ST_LPRF_AUDIO_LINES_TEST, ST_BT_WAKEUP_TEST, ST_BT_SLEEP_CLK_TEST fails or Bluetooth does not work
Go to Bluetooth troubleshooting
ST_EAR_DATA_LOOP_TEST failure / Audio(Mic/Earpiece/IHF) does not work
Go to Audio troubleshooting
ST_SLEEP_X_LOOP_TEST failure
SleepX or SleepClk line between D2800 (RAP) and N2300 (Betty) has failed
Go to power and charging troubleshooting
ST_UEM_CBUS_IF_TEST failure
ID reading from EM ASIC N2300 (Betty) and/or N2200 (Avilma) over CBUS has failed
Go to power and charging troubleshooting
ST_SLEEPCLK_FREQ_TEST failure
Sleepclk (SlClk of N2200) frequency not within limits 585.903-586.133
Change N2200 (Avilma)
ST_SECURITY_TEST failure
Try reflashing the phone.
Certificate restoring for BB5 products
Beyond economical repair
ST_BTEMP_TEST failure
Go to Charging Troubleshooting
ST_EXT_DEVICE_TEST failure
Go to Audio troubleshooting

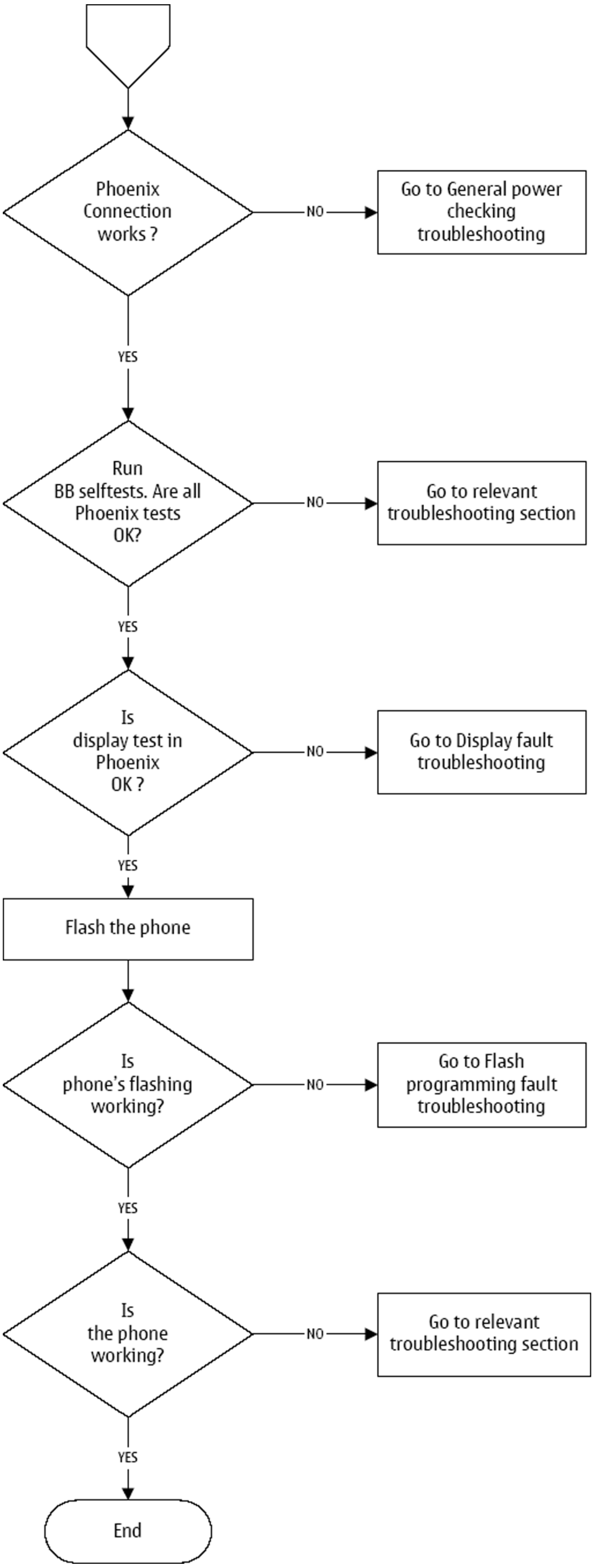
Power and charging troubleshooting

Dead or jammed device troubleshooting

Troubleshooting flow


Phone is dead or jammed
Press phone's power key -> Is phone's current consumption = 0
YES
Check supply voltage (VBat) and contacts in that line (e.g. battery connector)
Is there an open circuit somewhere?
YES
Try to make contact (e.g. by soldering)
NO
Connect Nokia approved charger. Is the phone waking up?
NO
Go to Charging troubleshooting
YES
Go to Power key troubleshooting
NO
Is phone's current consumption large? (about 1A or higher)
YES
Is some component very hot? (to the finger)
YES
Short circuit inside or under the component or some of its loads is short circuited (change the component which is short circuited)
NO
Go to General power checking troubleshooting
NO

Troubleshooting flow


Phoenix Connection works ?
NO
Go to General power checking troubleshooting
YES
Run BB selftests. Are all Phoenix tests OK?
NO
Go to relevant troubleshooting section
YES
Is display test in Phoenix OK ?
NO
Go to Display fault troubleshooting
YES
Flash the phone
Is phone's flashing working?
NO
Go to Flash programming fault troubleshooting
YES
Is the phone working?
NO
Go to relevant troubleshooting section
YES
End

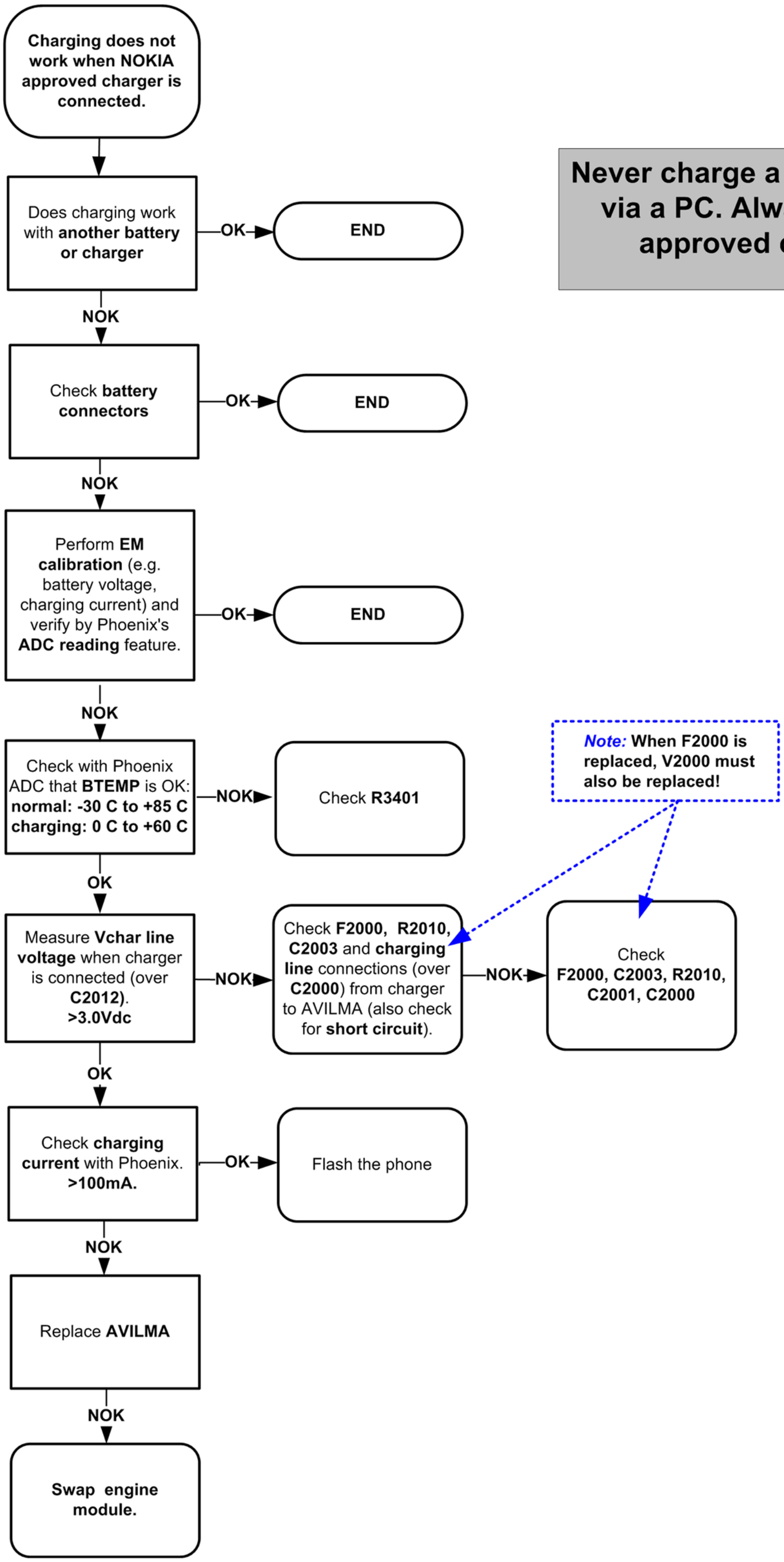
General power checking

Check the following voltages:

Signal name	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes
VIO	AVILMA	ON	ON	1.82	Memory, I/Os, Display	
VBACK	AVILMA	ON	ON	2.5	Back-up battery	
VSIM1	AVILMA	ON	ON	1.8/3.0	SIM card	
VDRAM	AVILMA	ON	ON	1.82	SDRAM	
VAUX	AVILMA	OFF	OFF	2.5	Camera, ALS, Display	
VR1	AVILMA	OFF	ON	2.5	Crystal oscillators, Ahneus	
VRFC	AVILMA	OFF	ON	1.8	RAP3G converters	
VRCP1	AVILMA			4.75	To RF parts	RF active
VREF	AVILMA	ON	ON	1.35	RF reference	
VCORE	BETTY	ON	ON	1.05 - 1.40	RAP3G digital	
VOUT	BETTY	OFF	OFF	2.5		Accessory connected
VCAM_2V8	LP3987ITLX-2.85/N3351	OFF	OFF	2.850	Camera	Disabled in sleep
VCAM_1V8	LM3677TLX-1.82/L1000	OFF	OFF	1.800	Camera	Disabled in sleep
VSIM2_MMC	KMBGN000A/ L1001	OFF	OFF	1.8	Internal memory	Disabled in sleep

Charging troubleshooting

Troubleshooting flow

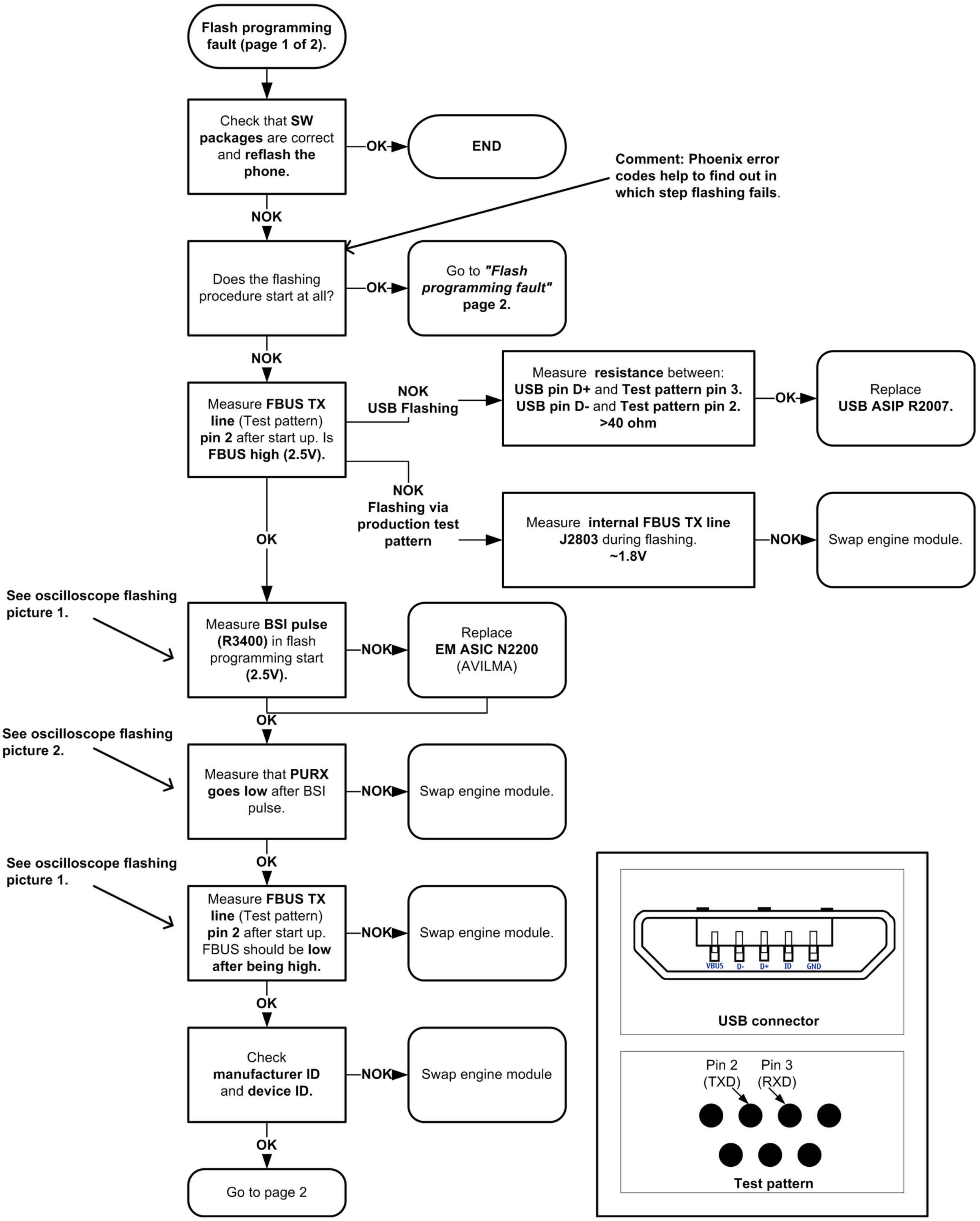

Charging does not work when NOKIA approved charger is connected.
Does charging work with another battery or charger
OK
END
NOK
Check battery connectors
OK
END
NOK
Perform EM calibration (e.g. battery voltage, charging current) and verify by Phoenix's ADC reading feature.
OK
END
NOK
Check with Phoenix ADC that BTEMP is OK: normal: -30 C to +85 C charging: 0 C to +60 C
NOK
Check R3401
Note: When F2000 is replaced, V2000 must also be replaced!
OK
Measure Vchar line voltage when charger is connected (over C2012). >3.0Vdc
NOK
Check F2000, R2010, C2003 and charging line connections (over C2000) from charger to AVILMA (also check for short circuit).
NOK
Check F2000, C2003, R2010, C2001, C2000
OK
Check charging current with Phoenix. >100mA.
OK
Flash the phone
NOK
Replace AVILMA
NOK
Swap engine module.

Never charge a *dead* battery via a PC. Always use an approved charger.

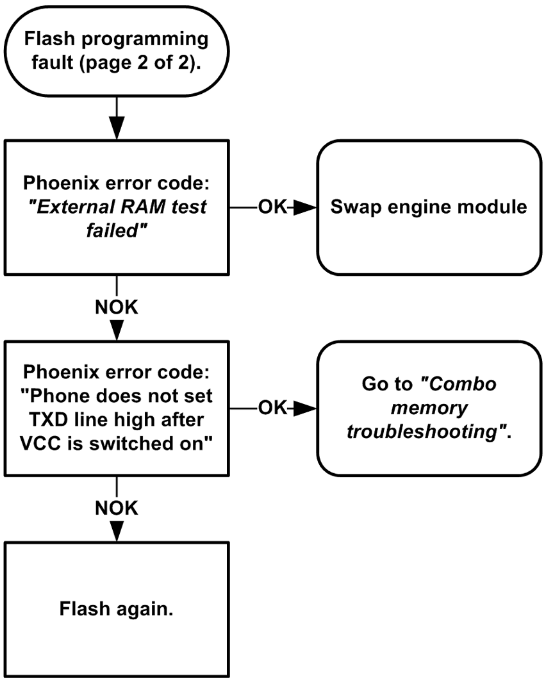
Interface troubleshooting

Flash programming fault troubleshooting

Part 1


Flash programming fault (page 1 of 2).
Check that SW packages are correct and reflash the phone.
OK
END
NOK
Comment: Phoenix error codes help to find out in which step flashing fails.
Does the flashing procedure start at all?
OK
Go to "Flash programming fault" page 2.
NOK
Measure FBUS TX line (Test pattern) pin 2 after start up. Is FBUS high (2.5V).
NOK USB Flashing
Measure resistance between: USB pin D+ and Test pattern pin 3. USB pin D- and Test pattern pin 2. >40 ohm
OK
Replace USB ASIP R2007.
NOK Flashing via production test pattern
Measure internal FBUS TX line J2803 during flashing. ~1.8V
NOK
Swap engine module.
OK
See oscilloscope flashing picture 1.
Measure BSI pulse (R3400) in flash programming start (2.5V).
NOK
Replace EM ASIC N2200 (AVILMA)
OK
See oscilloscope flashing picture 2.
Measure that PURX goes low after BSI pulse.
NOK
Swap engine module.
OK
See oscilloscope flashing picture 1.
Measure FBUS TX line (Test pattern) pin 2 after start up. FBUS should be low after being high.
NOK
Swap engine module.
OK
Check manufacturer ID and device ID.
NOK
Swap engine module
OK
Go to page 2
VBUS
D-
D+
ID
GND
USB connector
Pin 2 (TXD)
Pin 3 (RXD)
Test pattern

Part 2


Flash programming fault (page 2 of 2).
Phoenix error code: "External RAM test failed"
OK
Swap engine module
NOK
Phoenix error code: "Phone does not set TXD line high after VCC is switched on"
OK
Go to "Combo memory troubleshooting".
NOK
Flash again.

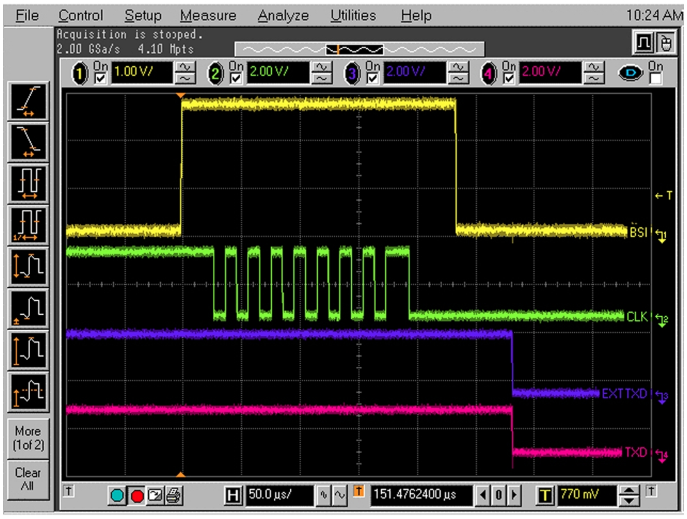
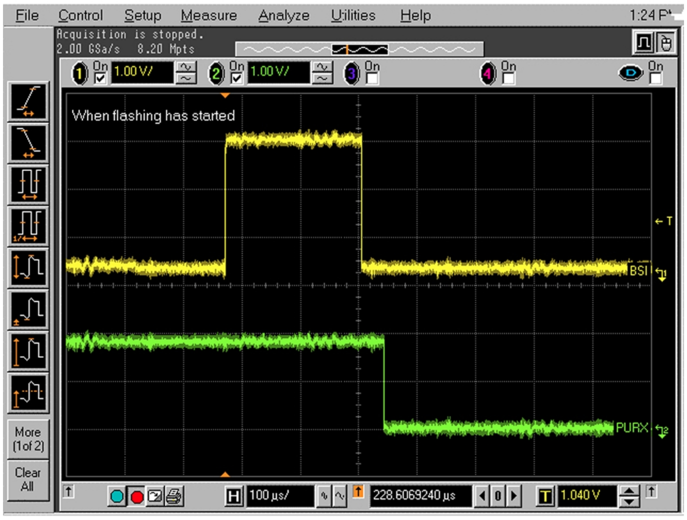

File
Control
Setup
Measure
Analyze
Utilities
Help
10:24 AM
Acquisition is stopped.
2.00 GSa/s 4.10 Mpts
1.00 V/
2.00 V/
2.00 V/
2.00 V/
BSI
CLK
EXTTXD
TXD
More (1of 2)
Clear All
50.0 µs/
151.4762400 µs
770 mV

Figure 8 Flashing pic 1. Take single trig measurement for the rise of the BSI signal.



Acquisition is stopped.
2.00 GSa/s 8.20 Mpts

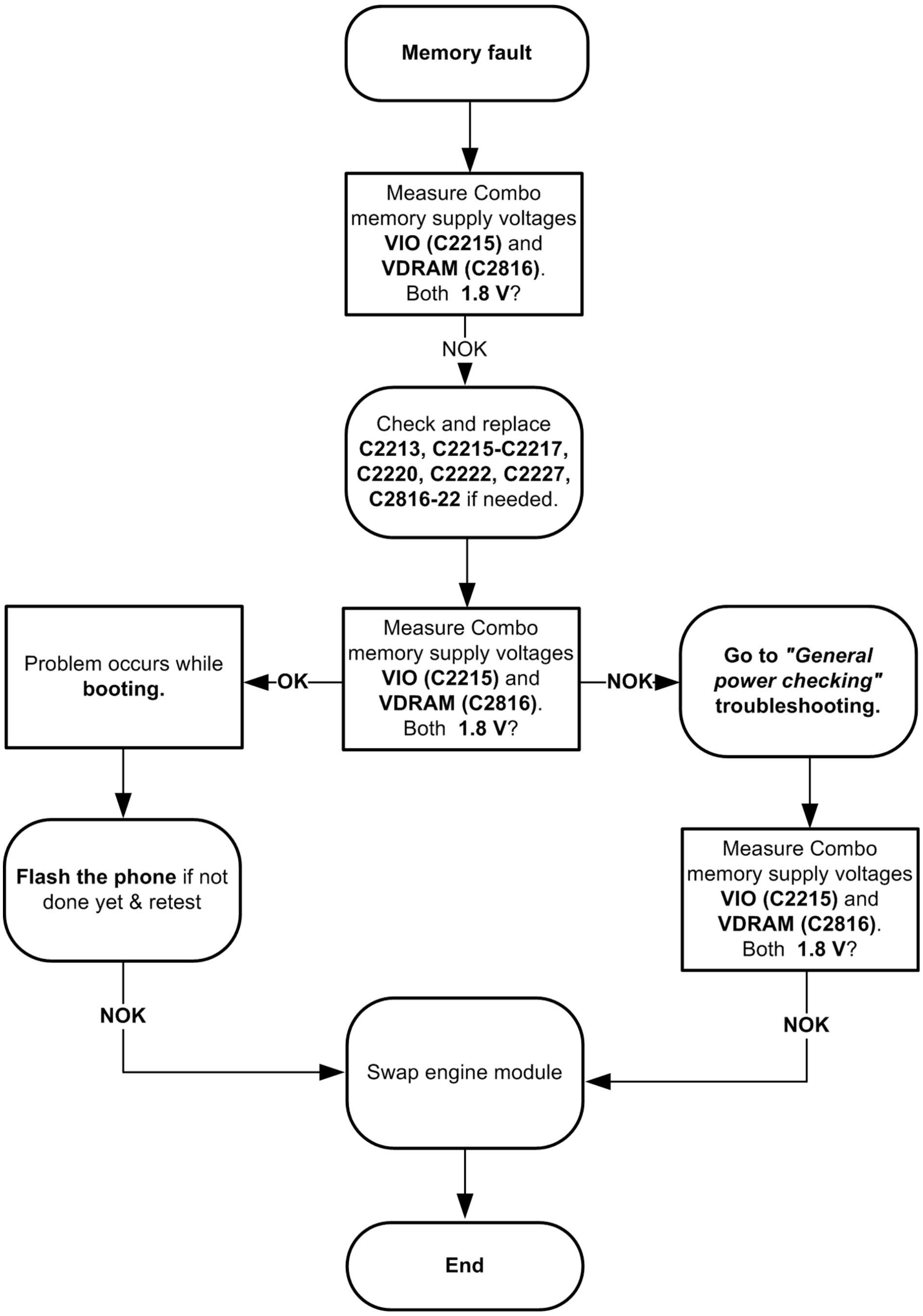
When flashing has started

File
Control
Setup
Measure
Analyze
Utilities
Help
1:24 P
1.00 V/
1.00 V/
On
More (1 of 2)
Clear All
T
BSI
PURX
100 µs/
228.6069240 µs
1.040 V

Figure 9 Flashing pic 2. Take single trig measurement for the rise of the BSI signal.

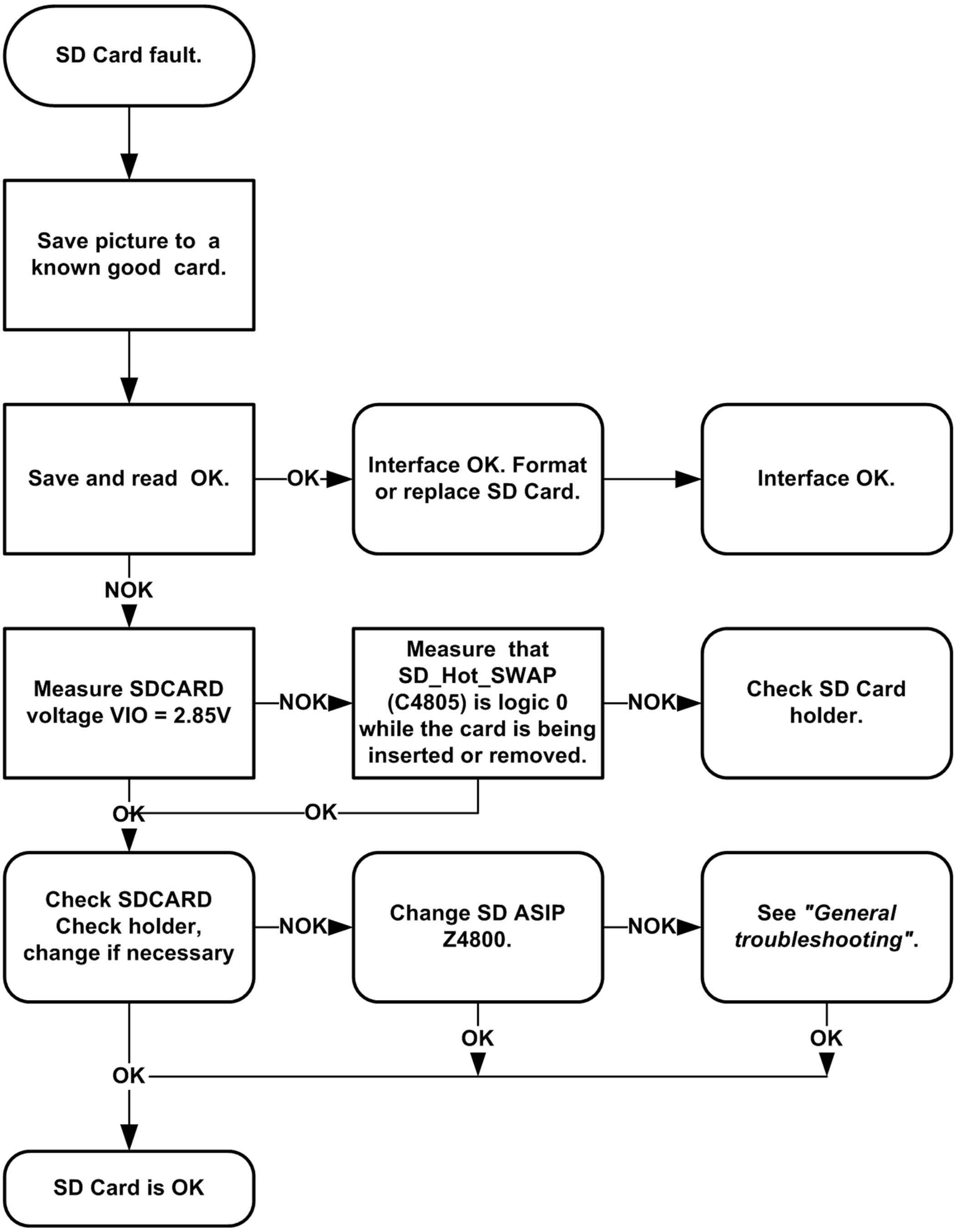
Combo memory troubleshooting

Troubleshooting flow


Memory fault
Measure Combo memory supply voltages VIO (C2215) and VDRAM (C2816). Both 1.8 V?
NOK
Check and replace C2213, C2215-C2217, C2220, C2222, C2227, C2816-22 if needed.
Measure Combo memory supply voltages VIO (C2215) and VDRAM (C2816). Both 1.8 V?
OK
Problem occurs while booting.
NOK
Go to "General power checking" troubleshooting.
Flash the phone if not done yet & retest
Measure Combo memory supply voltages VIO (C2215) and VDRAM (C2816). Both 1.8 V?
NOK
Swap engine module
NOK
End

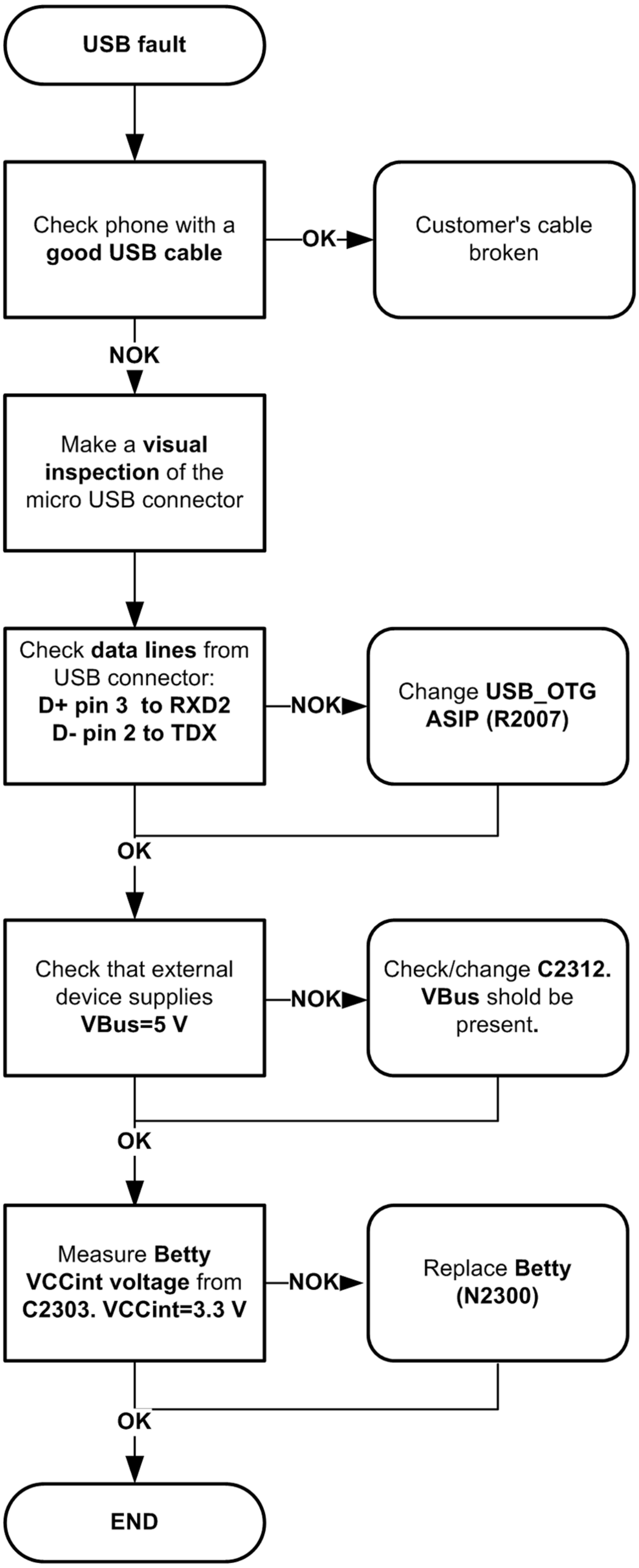
SD card troubleshooting

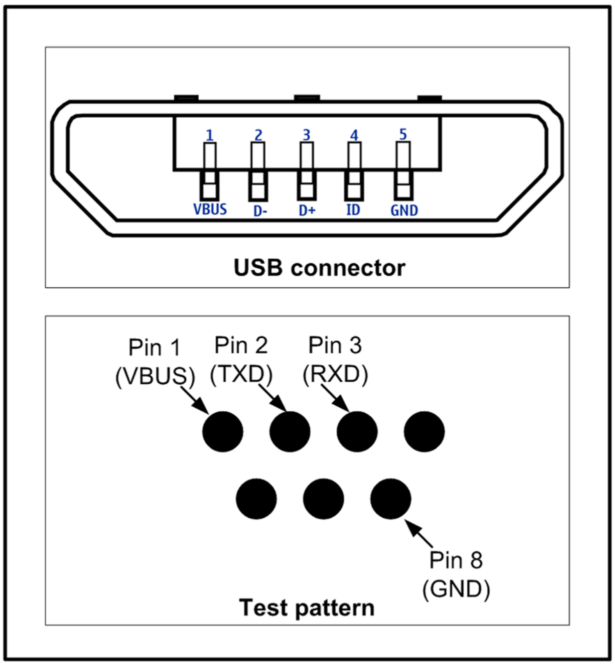
Troubleshooting flow


SD Card fault.
Save picture to a known good card.
Save and read OK.
OK
Interface OK. Format or replace SD Card.
Interface OK.
NOK
Measure SDCARD voltage VIO = 2.85V
NOK
Measure that SD_Hot_SWAP (C4805) is logic 0 while the card is being inserted or removed.
NOK
Check SD Card holder.
OK
OK
Check SDCARD Check holder, change if necessary
NOK
Change SD ASIP Z4800.
NOK
See *"General troubleshooting"*.
OK
OK
OK
SD Card is OK

USB interface troubleshooting

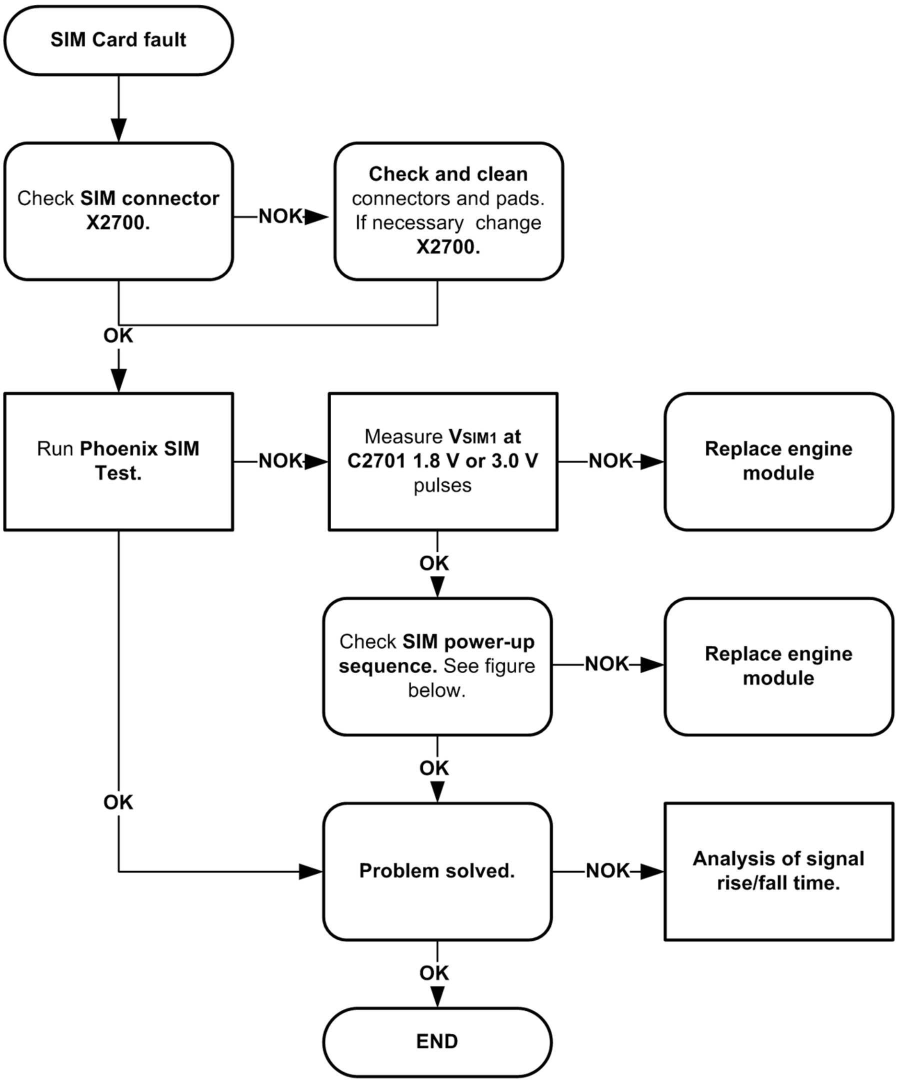
Troubleshooting flow

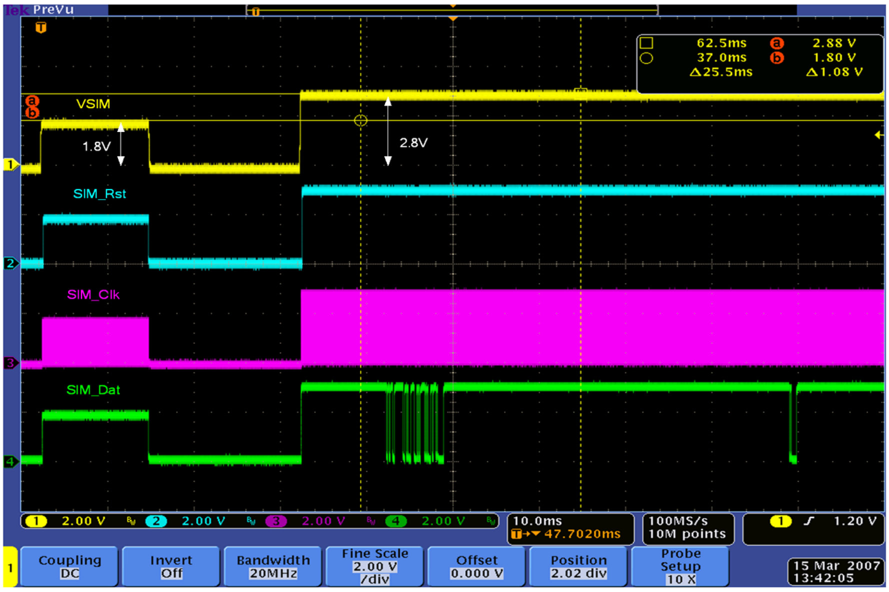

USB fault
Check phone with a good USB cable
OK
Customer's cable broken
NOK
Make a visual inspection of the micro USB connector
Check data lines from USB connector: D+ pin 3 to RXD2 D- pin 2 to TDX
NOK
Change USB_OTG ASIP (R2007)
OK
Check that external device supplies VBus=5 V
NOK
Check/change C2312. VBus shold be present.
OK
Measure Betty VCCint voltage from C2303. VCCint=3.3 V
NOK
Replace Betty (N2300)
OK
END


1
2
3
4
5
VBUS
D-
D+
ID
GND
USB connector
Pin 1 (VBUS)
Pin 2 (TXD)
Pin 3 (RXD)
Pin 8 (GND)
Test pattern

SIM card troubleshooting

Troubleshooting flow


SIM Card fault
Check SIM connector X2700.
NOK
Check and clean connectors and pads. If necessary change X2700.
OK
Run Phoenix SIM Test.
NOK
Measure VSIM1 at C2701 1.8 V or 3.0 V pulses
NOK
Replace engine module
OK
Check SIM power-up sequence. See figure below.
NOK
Replace engine module
OK
OK
Problem solved.
NOK
Analysis of signal rise/fall time.
OK
END


Tek PreVu
VSIM
1.8V
2.8V
SIM_Rst
SIM_Clk
SIM_Dat
62.5ms
37.0ms
Δ25.5ms
2.88 V
1.80 V
Δ1.08 V
1 2.00 V
2 2.00 V
3 2.00 V
4 2.00 V
10.0ms
47.7020ms
100MS/s
10M points
1 1.20 V
Coupling DC
Invert Off
Bandwidth 20MHz
Fine Scale 2.00 V /div
Offset 0.000 V
Position 2.02 div
Probe Setup 10 X
15 Mar 2007
13:42:05

User interface troubleshooting

Keypad troubleshooting

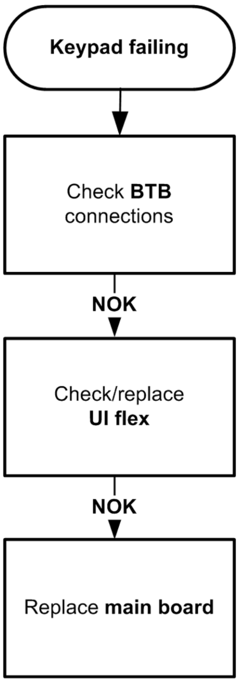
Context

There are two possible failure modes in the keyboard module:

- One or more keys are stuck, so that the key does not react when a keydome is pressed. This kind of failure is caused by mechanical reasons (dirt, rust, mechanical damage, etc.)
- Malfunction of several keys at the same time; this happens when one or more rows or columns in the key matrix are failing (shortcut or open connection).

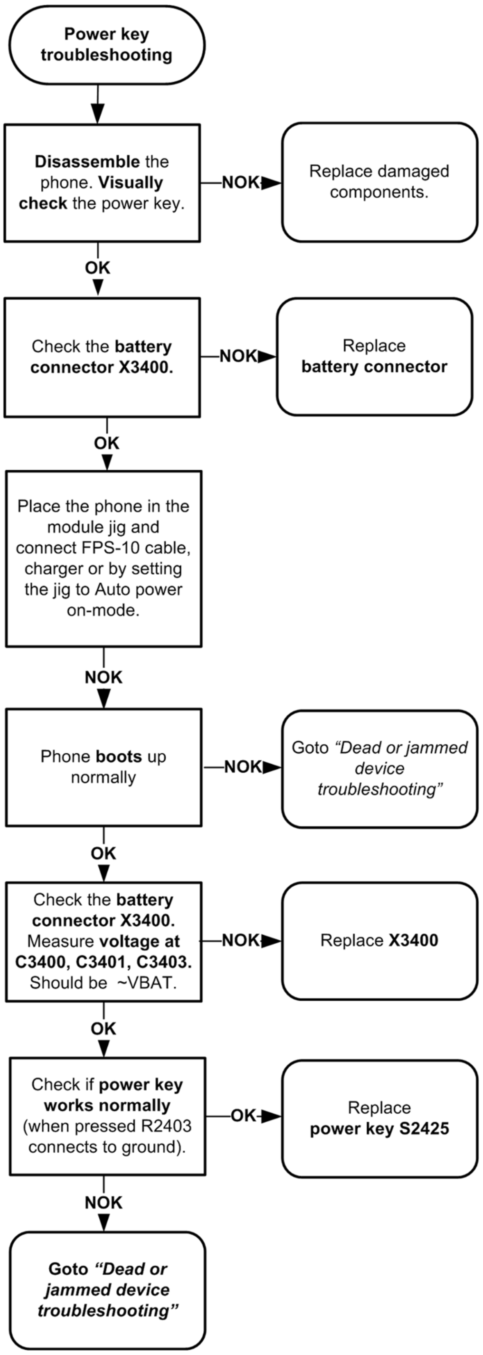
If the failure mode is not clear, start with the Keyboard test in Phoenix.

Troubleshooting flow


Keypad failing
Check BTB connections
NOK
Check/replace UI flex
NOK
Replace main board

Power key troubleshooting

Troubleshooting flow


Power key troubleshooting
Disassemble the phone. Visually check the power key.
NOK
Replace damaged components.
OK
Check the battery connector X3400.
NOK
Replace battery connector
OK
Place the phone in the module jig and connect FPS-10 cable, charger or by setting the jig to Auto power on-mode.
NOK
Phone boots up normally
NOK
Goto "Dead or jammed device troubleshooting"
OK
Check the battery connector X3400. Measure voltage at C3400, C3401, C3403. Should be ~VBAT.
NOK
Replace X3400
OK
Check if power key works normally (when pressed R2403 connects to ground).
OK
Replace power key S2425
NOK
Goto "Dead or jammed device troubleshooting"

Display module troubleshooting

General instructions for display troubleshooting

Context

- The display is in a normal mode when the phone is in active use.
- Display is in a partial idle mode when the phone is in the screen saver mode.

- The operating modes of the display can be controlled with the help of *Phoenix*.

Table 7 Display module troubleshooting cases

Display blank	There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or a part of the image can be missing. If a part of the image is missing, change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the following table.

Table 8 Pixel defects

Item		White dot defect				Black dot defect	Total
1	Defect counts	R	G	B	White Dot Total	1	1
		1	1	1	1		
2	Combined defect counts	Not allowed. Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect.					

Steps

1. Verify with a working display that the fault is not on the display module itself.

   The display module cannot be repaired.

2. Check that the cellular engine is working normally.

   i To check the functionality, connect the phone to a docking station.

   ii Start *Phoenix* service software.

   iii Read the phone information to check that also the application engine is functioning normally (you should be able to read the APE ID).

3. Proceed to the display troubleshooting flowcharts.

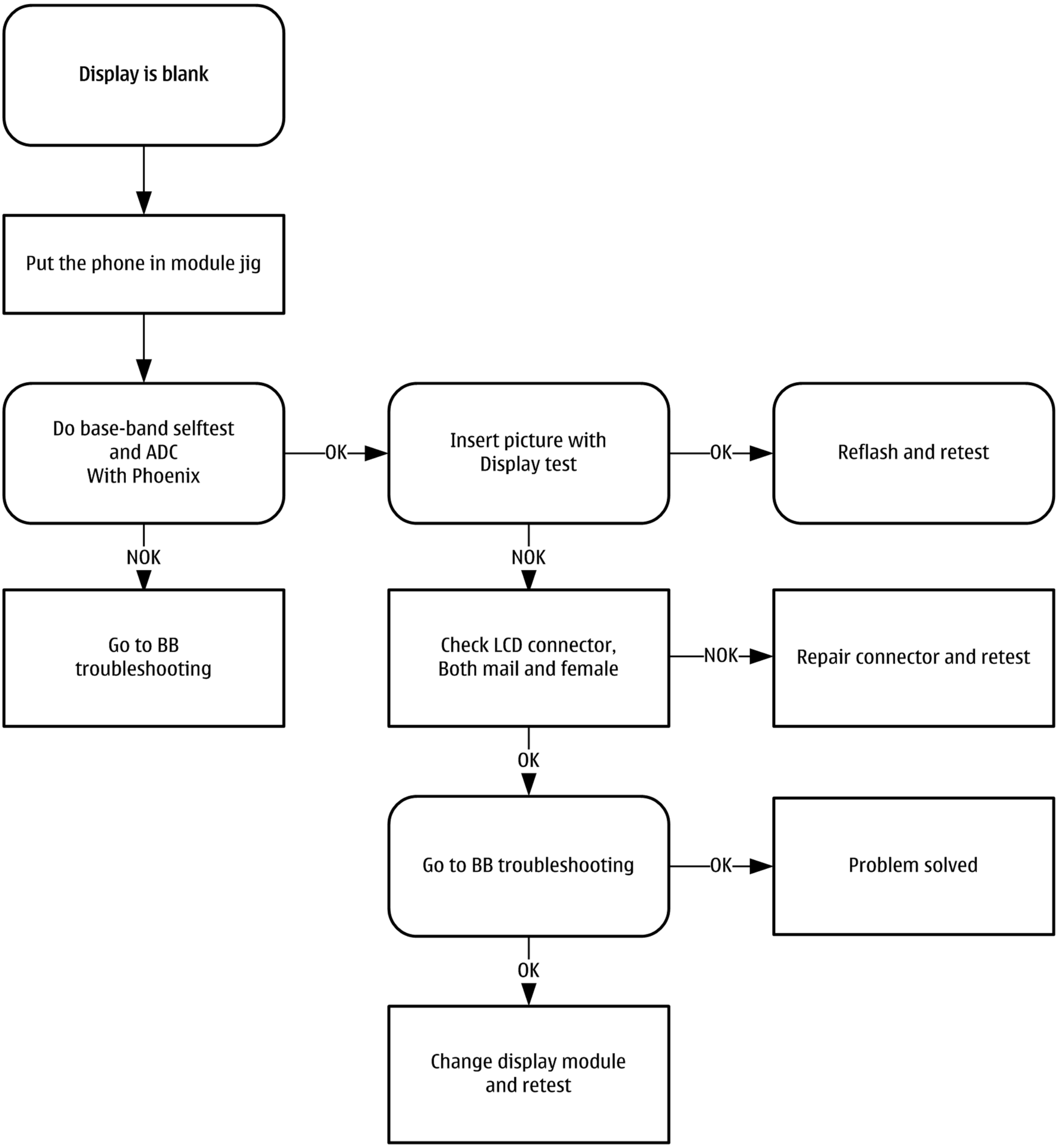
   Use the **Display Test** tool in *Phoenix* to find the detailed fault mode.

Blank display troubleshooting

Context

The phone is in normal mode and there is no image on the display. Display back light could be on in some cases.

Troubleshooting flow

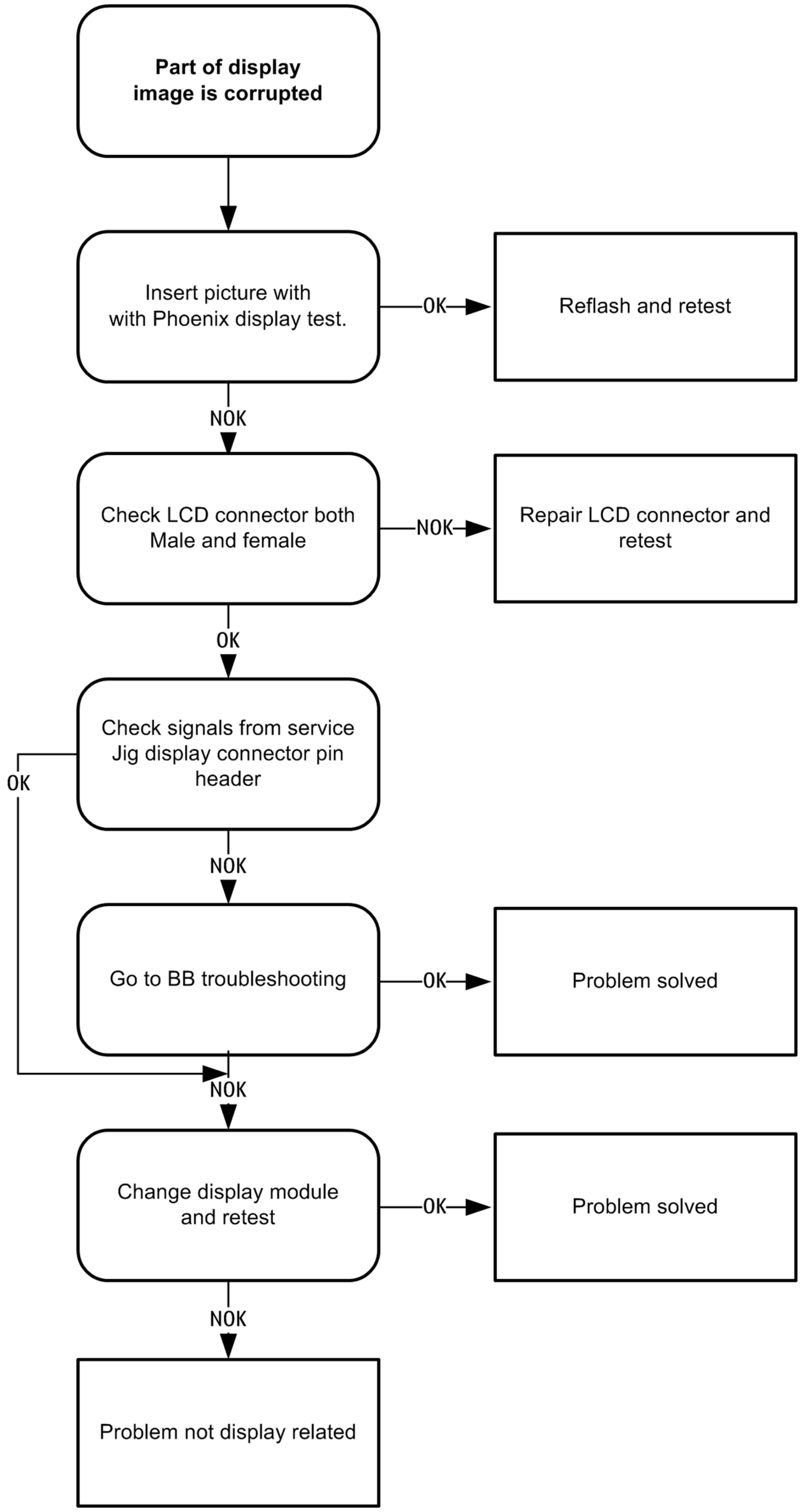

Display is blank
Put the phone in module jig
Do base-band selftest and ADC With Phoenix
OK
Insert picture with Display test
OK
Reflash and retest
NOK
Go to BB troubleshooting
NOK
Check LCD connector, Both mail and female
NOK
Repair connector and retest
OK
Go to BB troubleshooting
OK
Problem solved
OK
Change display module and retest

Faulty image troubleshooting

Context

The image on the display is corrupted or part of the image is missing. If a part of the image is missing, change the display module. Otherwise, follow the flowchart below.

Troubleshooting flow

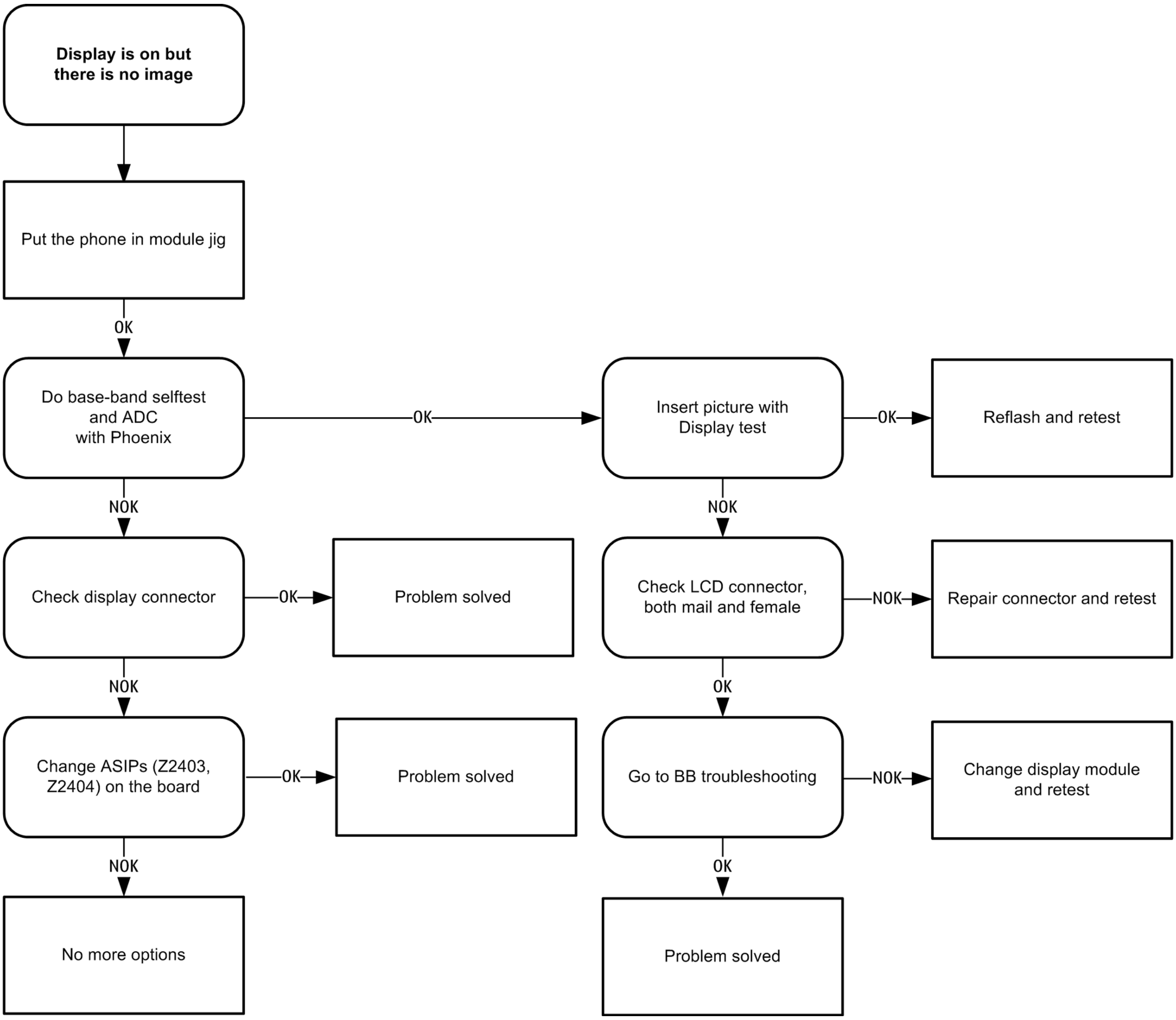

Part of display image is corrupted
Insert picture with with Phoenix display test.
OK
Reflash and retest
NOK
Check LCD connector both Male and female
NOK
Repair LCD connector and retest
OK
Check signals from service Jig display connector pin header
OK
NOK
Go to BB troubleshooting
OK
Problem solved
NOK
Change display module and retest
OK
Problem solved
NOK
Problem not display related

Display on but no image troubleshooting

Context

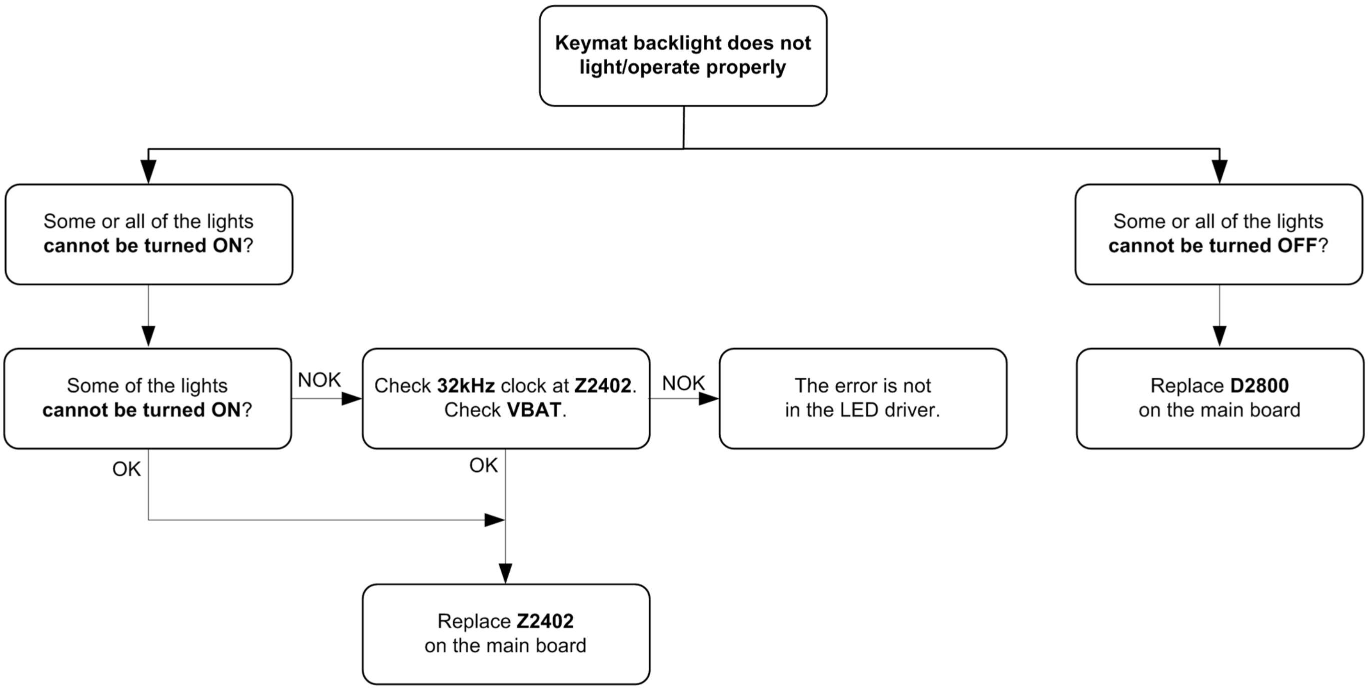
The phone is on, display active and blank, but no image.

Troubleshooting flow


Display is on but there is no image
Put the phone in module jig
OK
Do base-band selftest and ADC with Phoenix
OK
Insert picture with Display test
OK
Reflash and retest
NOK
Check display connector
OK
Problem solved
NOK
Check LCD connector, both mail and female
NOK
Repair connector and retest
NOK
Change ASIPs (Z2403, Z2404) on the board
OK
Problem solved
OK
Go to BB troubleshooting
NOK
Change display module and retest
NOK
No more options
OK
Problem solved

Keyboard backlight troubleshooting

Troubleshooting flow


Keymat backlight does not light/operate properly
Some or all of the lights cannot be turned ON?
Some or all of the lights cannot be turned OFF?
Some of the lights cannot be turned ON?
NOK
Check 32kHz clock at Z2402. Check VBAT.
NOK
The error is not in the LED driver.
Replace D2800 on the main board
OK
OK
Replace Z2402 on the main board

Camera module troubleshooting

Introduction to camera troubleshooting

Bad conditions often cause bad pictures. Therefore, the camera operation has to be checked in constant conditions or by using a second, known-to-be-good Nokia device as reference. Image quality is hard to measure quantitatively, and the difference between a good and a bad picture can be small. Some training or experience may be needed to detect what is actually wrong.

When checking for possible errors in camera functionality, knowing what error is suspected significantly helps the testing by narrowing down the amount of test cases. The following types of image quality problems are common:

- Dust (black spots)
- Lack of sharpness
- Bit errors

Main (back) camera troubleshooting

Taking and evaluating test pictures with main camera

When *taking* a test picture, remember the following:

- Avoid bright fluorescent light, 50/60Hz electrical network or high artificial illumination levels
- If the phone is hot, let it rest for a while before taking the picture
- Make sure the optical system is clean
- Use highest possible resolution
- Make sure the light is sufficient (bright office lightning)

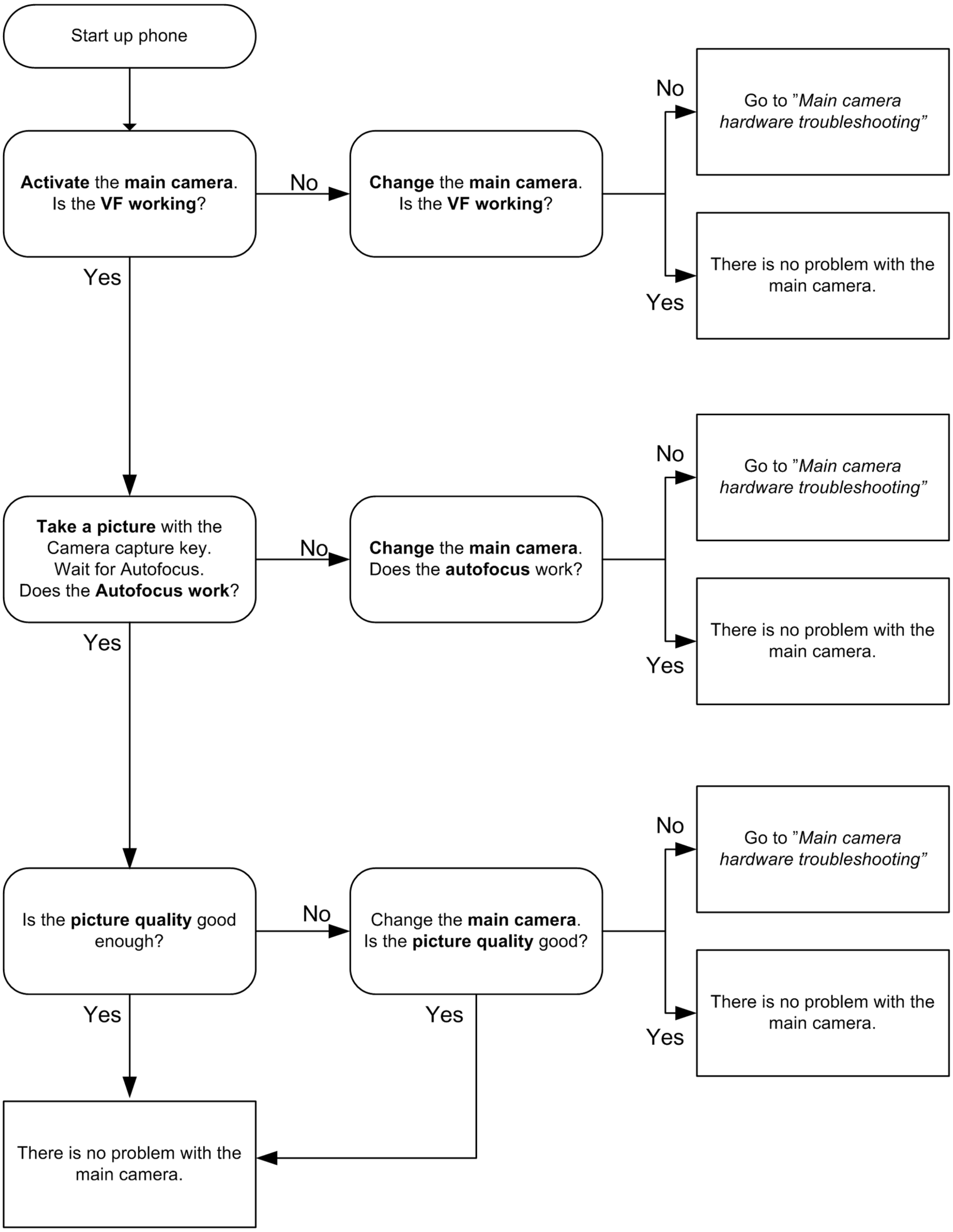
- Do not take the picture towards a light source
- Hold the phone as still as possible when taking the picture
- If camera has auto focus: Pictures should be taken both at infinity ~>2m and at macro distance ~10-15 cm in order to verify auto focus functionality

When *evaluating* a test picture, remember the following:

- The center of the picture is sharper than the edges
- The image may be blurred, though it does not show in the viewfinder
- Analyse the picture from your PC monitor, full colour setting is recommended
- If possible, compare with a picture of the same motive taken with a similar Nokia device
- If camera has auto focus: Remember that the white focussing frame which appears when the camera button is pressed halfway down, must turn green for auto focus lock. If the frame turns red, the camera is not focussed!

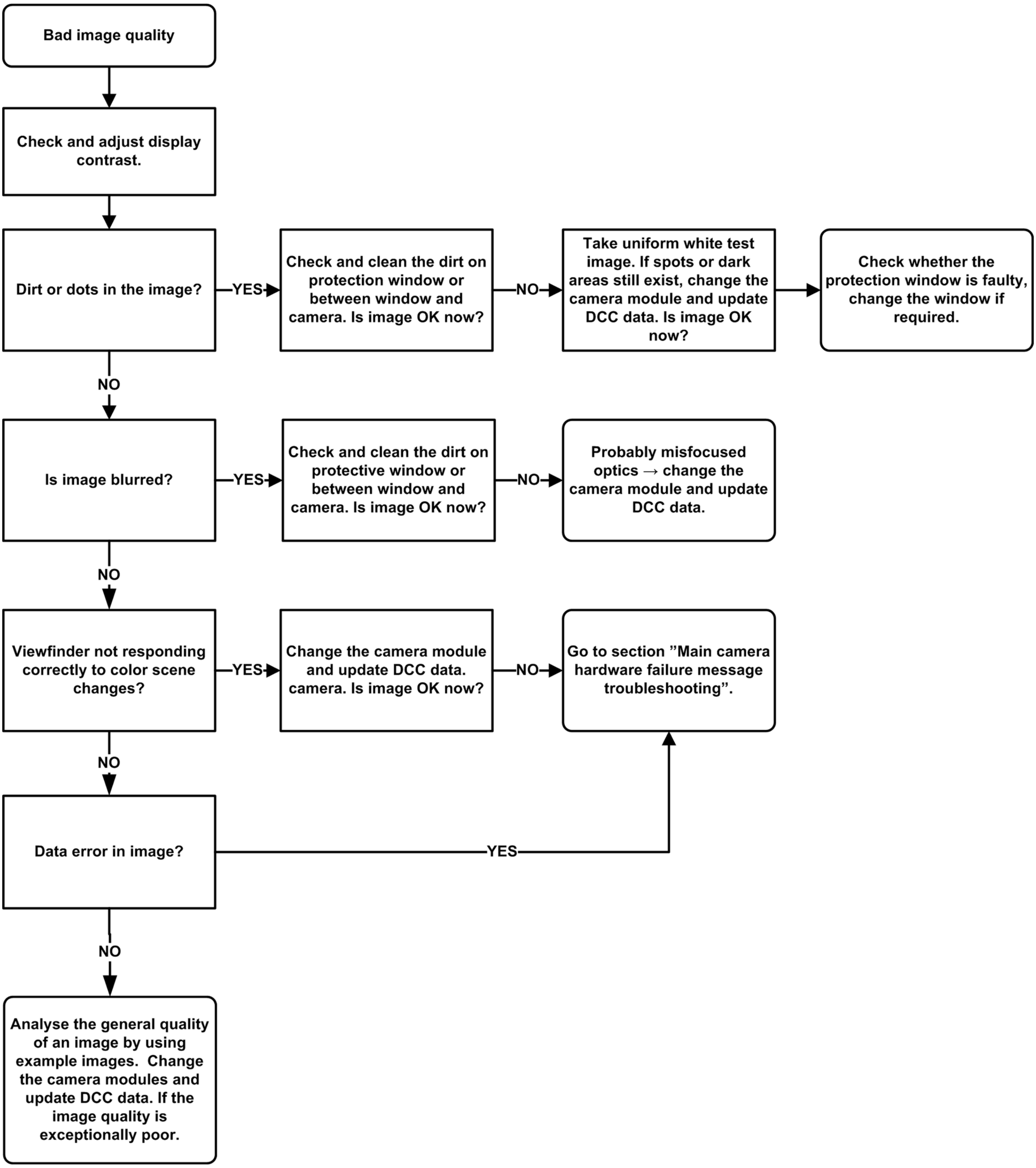
Main camera troubleshooting

Troubleshooting flow


Start up phone
Activate the main camera. Is the VF working?
No
Change the main camera. Is the VF working?
No
Go to "Main camera hardware troubleshooting"
Yes
There is no problem with the main camera.
Yes
Take a picture with the Camera capture key. Wait for Autofocus. Does the Autofocus work?
No
Change the main camera. Does the autofocus work?
No
Go to "Main camera hardware troubleshooting"
Yes
There is no problem with the main camera.
Yes
Is the picture quality good enough?
No
Change the main camera. Is the picture quality good?
No
Go to "Main camera hardware troubleshooting"
Yes
There is no problem with the main camera.
Yes
Yes
There is no problem with the main camera.

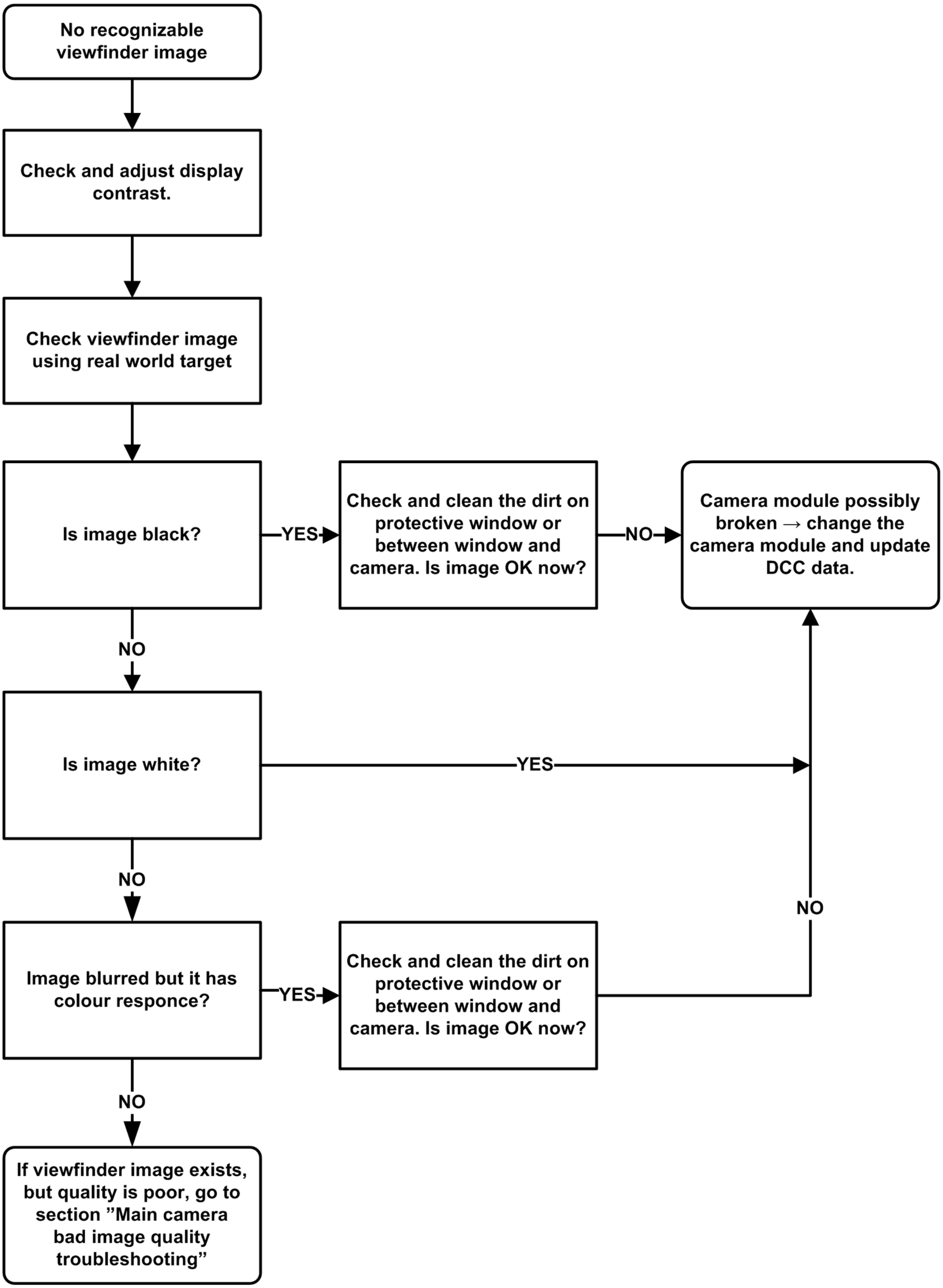
Main camera bad image quality troubleshooting

Troubleshooting flow


Bad image quality
Check and adjust display contrast.
Dirt or dots in the image?
YES
Check and clean the dirt on protection window or between window and camera. Is image OK now?
NO
Take uniform white test image. If spots or dark areas still exist, change the camera module and update DCC data. Is image OK now?
Check whether the protection window is faulty, change the window if required.
NO
Is image blurred?
YES
Check and clean the dirt on protective window or between window and camera. Is image OK now?
NO
Probably misfocused optics → change the camera module and update DCC data.
NO
Viewfinder not responding correctly to color scene changes?
YES
Change the camera module and update DCC data. camera. Is image OK now?
NO
Go to section "Main camera hardware failure message troubleshooting".
NO
Data error in image?
YES
NO
Analyse the general quality of an image by using example images. Change the camera modules and update DCC data. If the image quality is exceptionally poor.

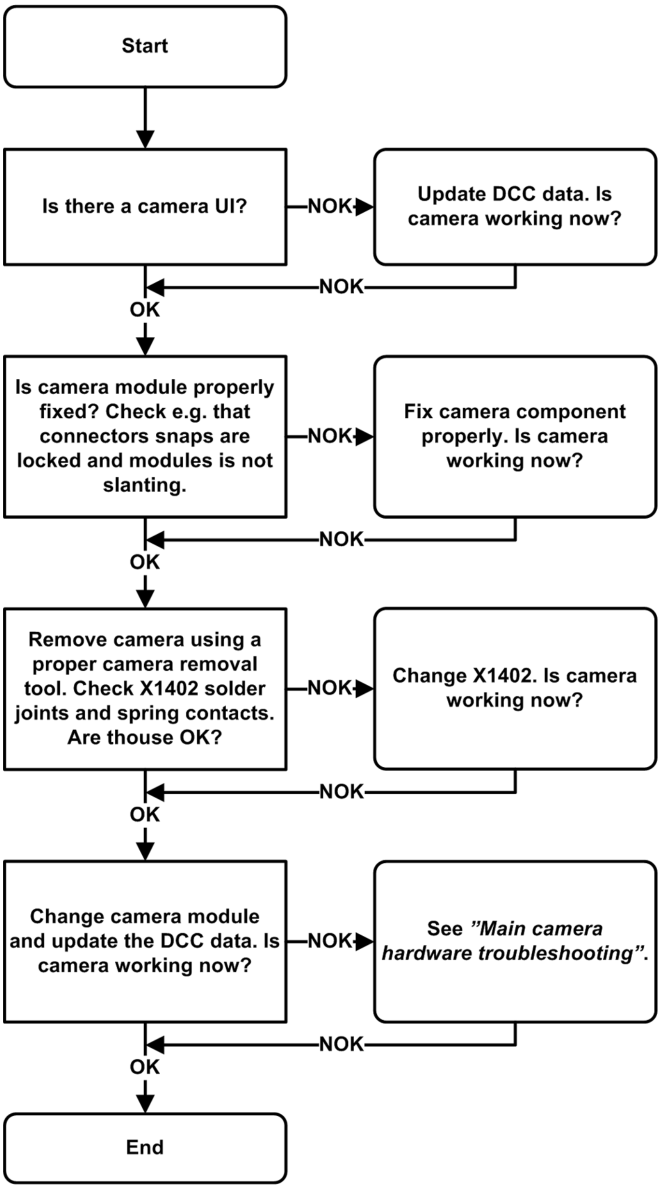
Main camera viewfinder troubleshooting

Troubleshooting flow


No recognizable viewfinder image
Check and adjust display contrast.
Check viewfinder image using real world target
Is image black?
YES
Check and clean the dirt on protective window or between window and camera. Is image OK now?
NO
Camera module possibly broken → change the camera module and update DCC data.
NO
Is image white?
YES
NO
Image blurred but it has colour responce?
YES
Check and clean the dirt on protective window or between window and camera. Is image OK now?
NO
NO
If viewfinder image exists, but quality is poor, go to section "Main camera bad image quality troubleshooting"

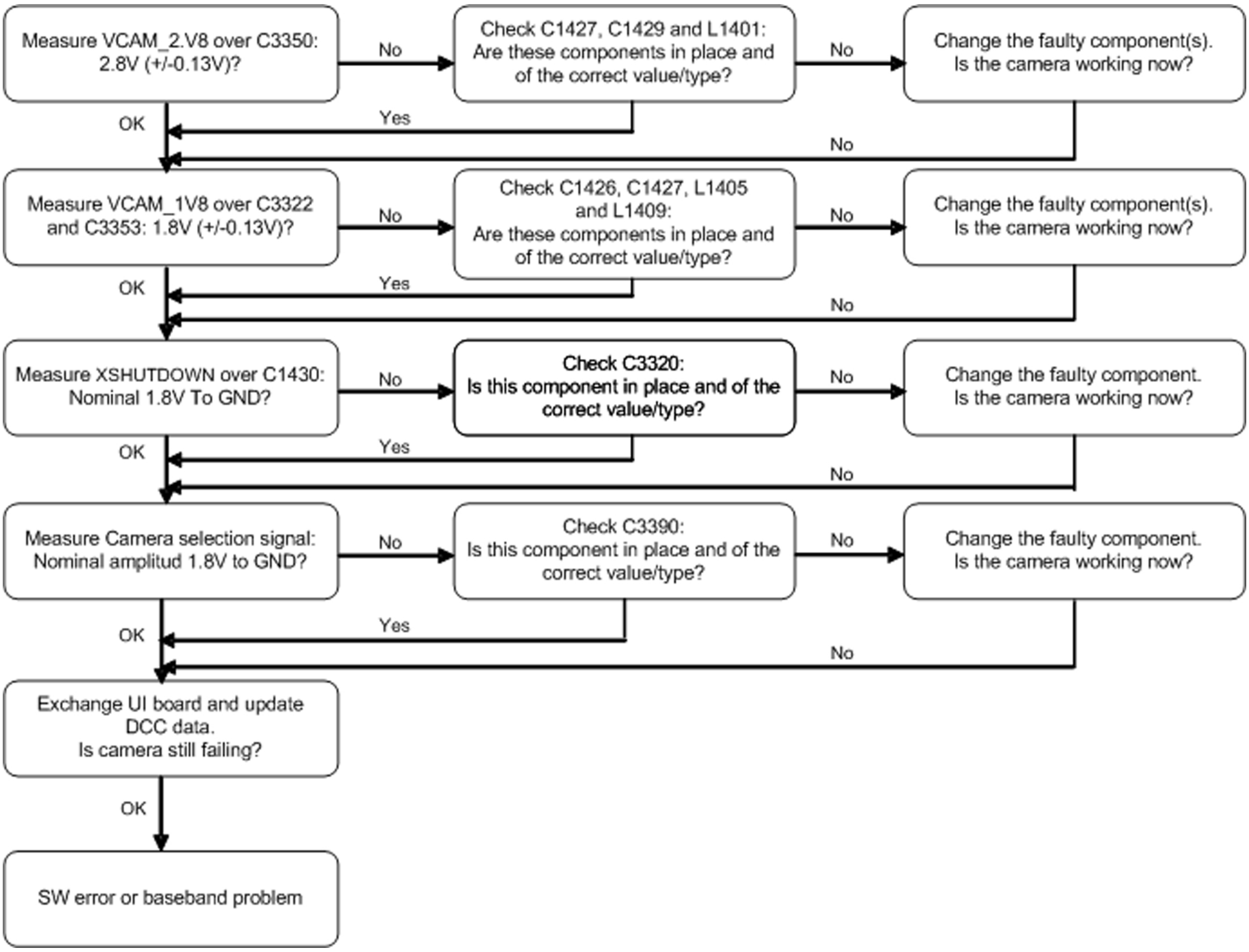
Main camera hardware failure message troubleshooting

Troubleshooting flow


Start
Is there a camera UI?
NOK
Update DCC data. Is camera working now?
NOK
OK
Is camera module properly fixed? Check e.g. that connectors snaps are locked and modules is not slanting.
NOK
Fix camera component properly. Is camera working now?
NOK
OK
Remove camera using a proper camera removal tool. Check X1402 solder joints and spring contacts. Are thouse OK?
NOK
Change X1402. Is camera working now?
NOK
OK
Change camera module and update the DCC data. Is camera working now?
NOK
See *"Main camera hardware troubleshooting"*.
NOK
OK
End

Main camera hardware troubleshooting

Troubleshooting flow

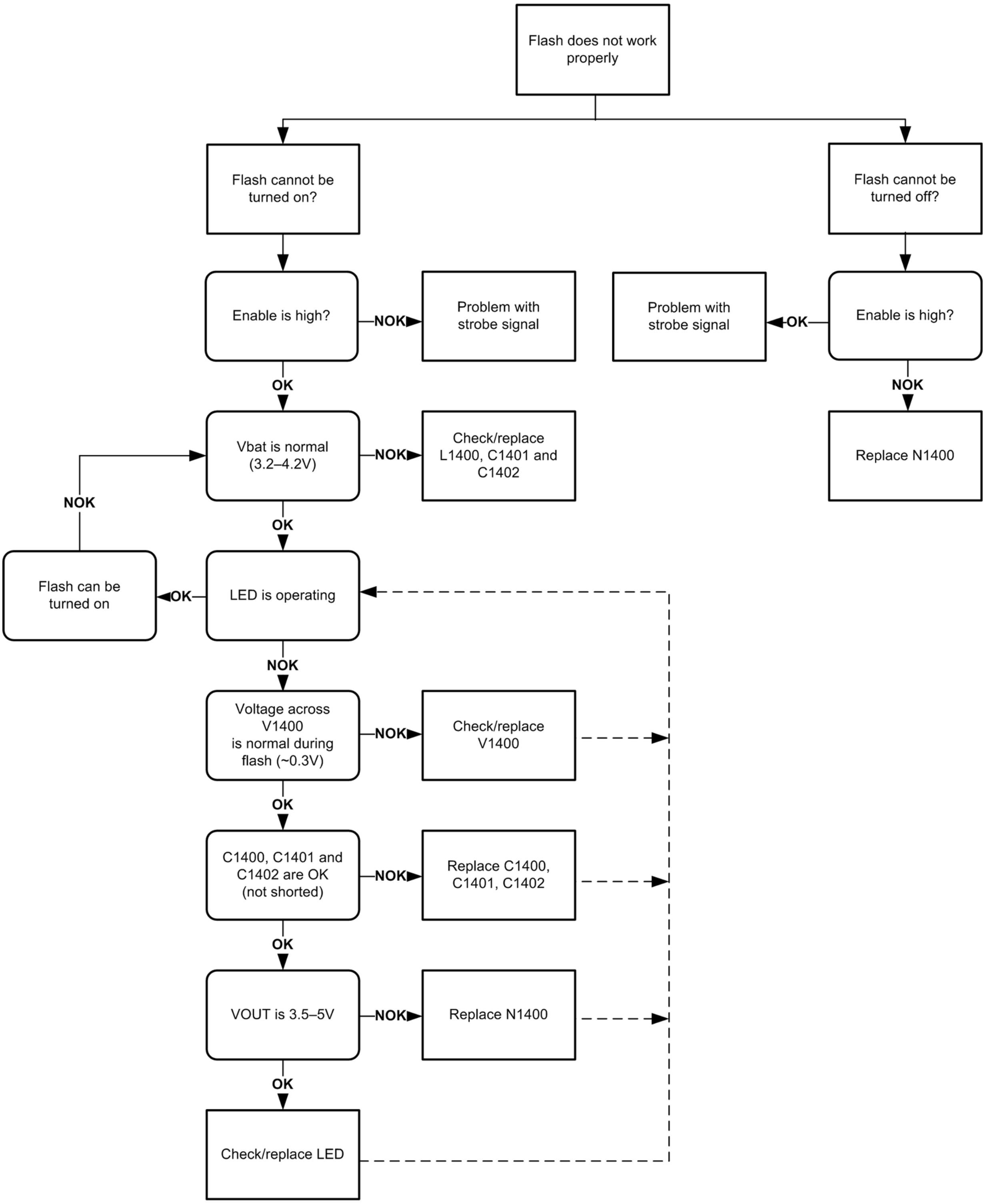

Measure VCAM_2.V8 over C3350: 2.8V (+/-0.13V)?
No
Check C1427, C1429 and L1401: Are these components in place and of the correct value/type?
No
Change the faulty component(s). Is the camera working now?
OK
Yes
No
Measure VCAM_1V8 over C3322 and C3353: 1.8V (+/-0.13V)?
No
Check C1426, C1427, L1405 and L1409: Are these components in place and of the correct value/type?
No
Change the faulty component(s). Is the camera working now?
OK
Yes
No
Measure XSHUTDOWN over C1430: Nominal 1.8V To GND?
No
Check C3320: Is this component in place and of the correct value/type?
No
Change the faulty component. Is the camera working now?
OK
Yes
No
Measure Camera selection signal: Nominal amplitud 1.8V to GND?
No
Check C3390: Is this component in place and of the correct value/type?
No
Change the faulty component. Is the camera working now?
OK
Yes
No
Exchange UI board and update DCC data. Is camera still failing?
OK
SW error or baseband problem

Camera LED flash troubleshooting

Context

Note: There are three different flash modes.

Troubleshooting flow


Flash does not work properly
Flash cannot be turned on?
Flash cannot be turned off?
Enable is high?
NOK
Problem with strobe signal
Problem with strobe signal
OK
Enable is high?
OK
NOK
Vbat is normal (3.2–4.2V)
NOK
Check/replace L1400, C1401 and C1402
Replace N1400
NOK
OK
Flash can be turned on
OK
LED is operating
NOK
Voltage across V1400 is normal during flash (~0.3V)
NOK
Check/replace V1400
OK
C1400, C1401 and C1402 are OK (not shorted)
NOK
Replace C1400, C1401, C1402
OK
VOUT is 3.5–5V
NOK
Replace N1400
OK
Check/replace LED

Secondary (front) camera troubleshooting

Evaluating videocall picture quality from secondary camera

When testing the picture quality of a videocall, remember the following:

- Avoid bright fluorescent light, 50/60Hz electrical network or high artificial illumination levels
- Make sure the optical system is clean
- Make sure the light is suffiecient (bright office lightning)
- Do not take the picture towards light source
- Hold the phone as still as possible when evaluating the video call image quality.
- Distance should be approximately 40 cm

When *evaluating* the picture quality of a video call, remember the following:

> **Note:** Always use the "troubled" phone when evaluating a picture in a video call. Do not evaluate the picture on the receiving phone.

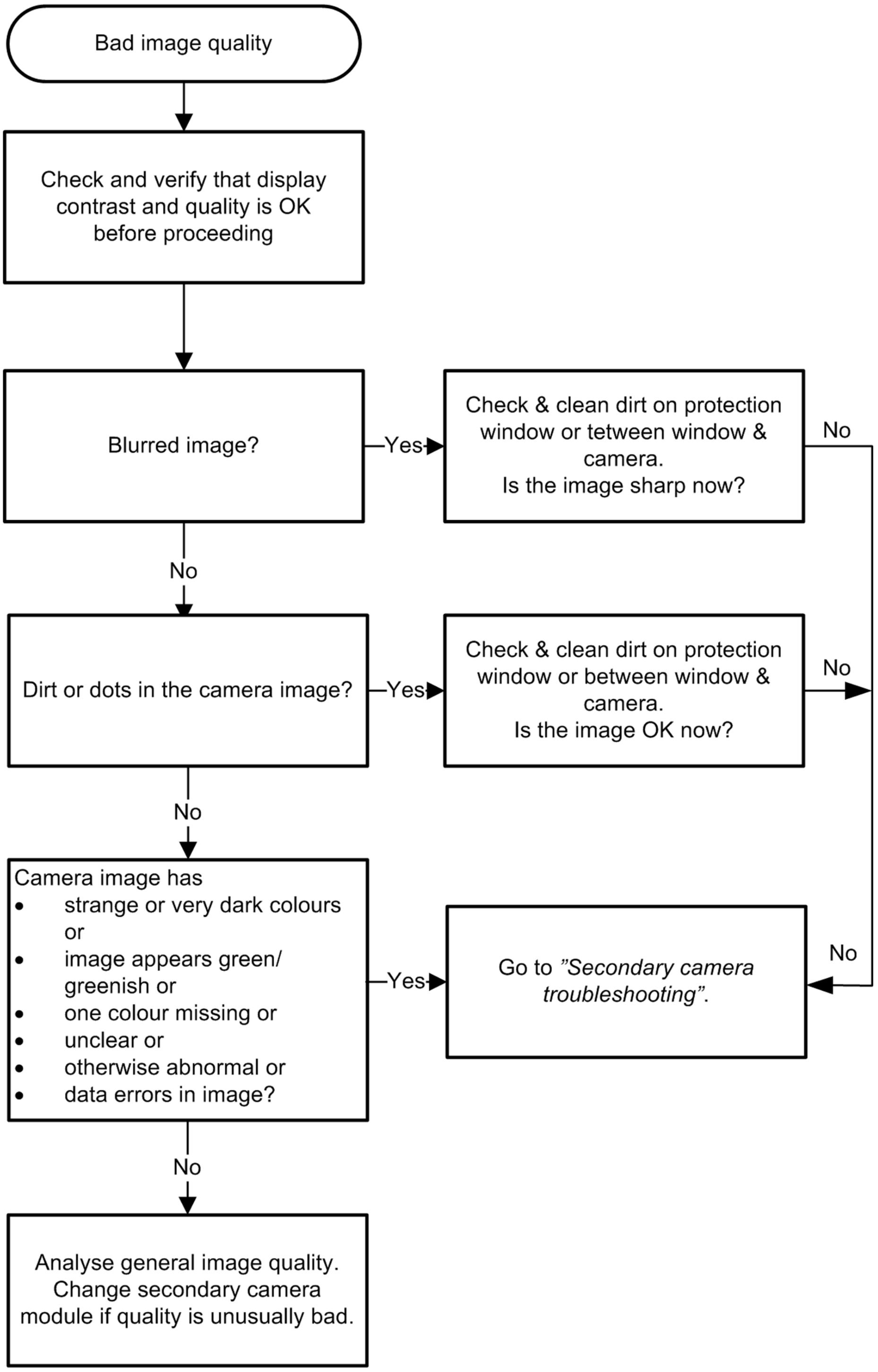
- The center of the picture is sharper than the edges
- If possible, compare with the picture on another Nokia device in a videocall, and of the same motive.

Secondary camera bad image quality troubleshooting

Troubleshooting flow

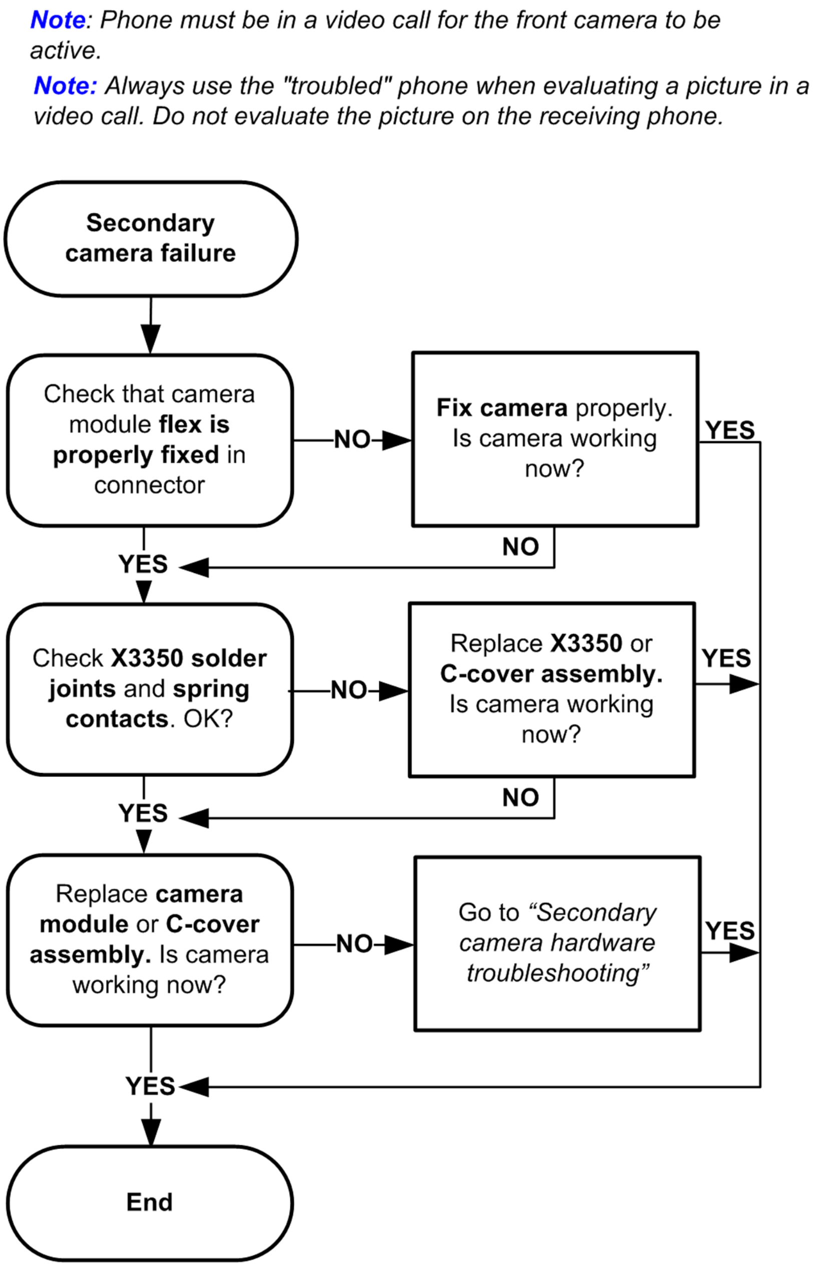
Note: Phone must be in a video call for the front camera to be active.

Note: Always use the "troubled" phone when evaluating a picture in a video call. Do not evaluate the picture on the receiving phone.


Bad image quality
Check and verify that display contrast and quality is OK before proceeding
Blurred image?
Yes
Check & clean dirt on protection window or tetween window & camera.
Is the image sharp now?
No
No
Dirt or dots in the camera image?
Yes
Check & clean dirt on protection window or between window & camera.
Is the image OK now?
No
No
Camera image has
• strange or very dark colours or
• image appears green/ greenish or
• one colour missing or
• unclear or
• otherwise abnormal or
• data errors in image?
Yes
Go to "Secondary camera troubleshooting".
No
No
Analyse general image quality. Change secondary camera module if quality is unusually bad.

Secondary camera troubleshooting

Troubleshooting flow

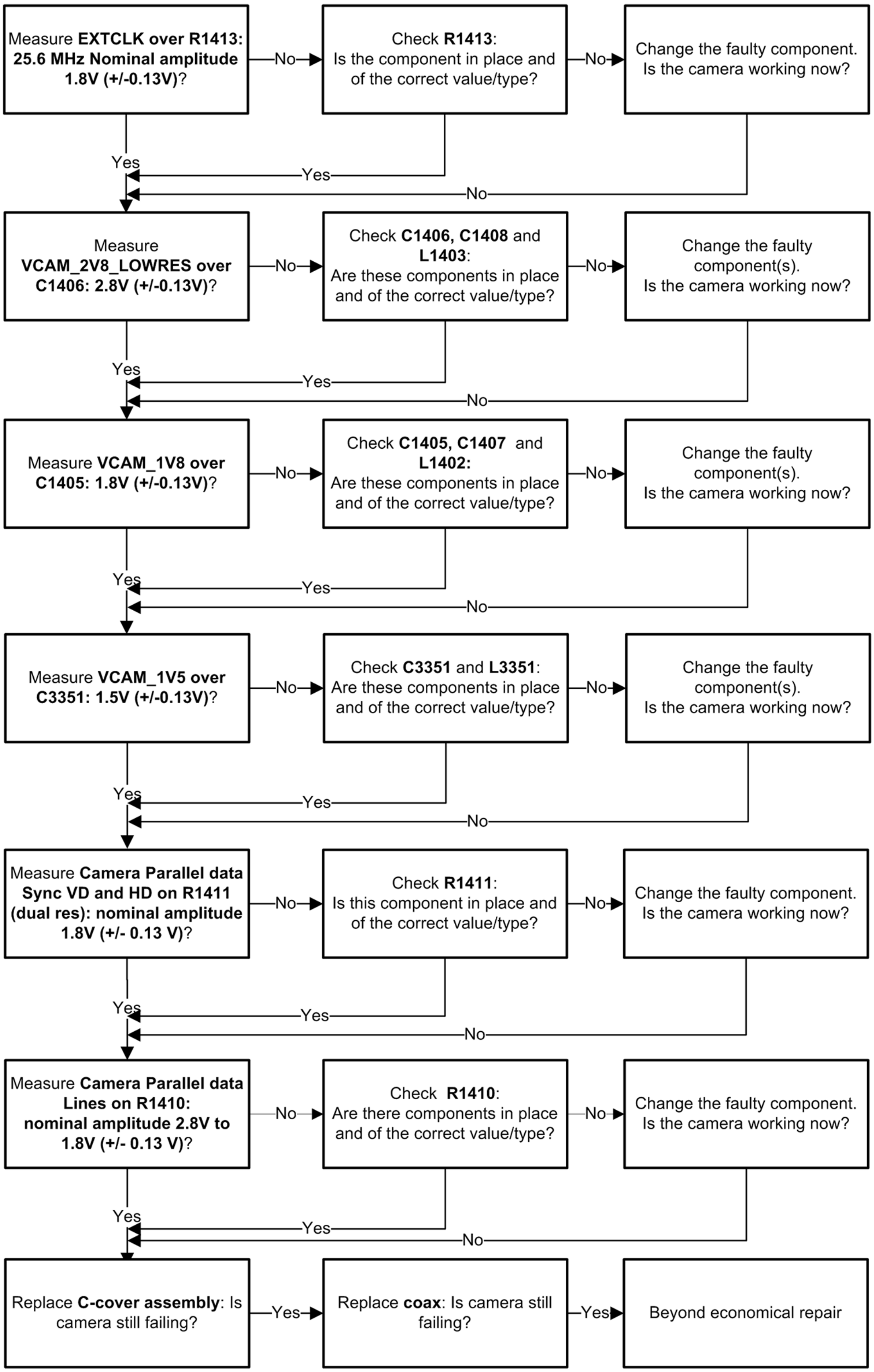

Note: *Phone must be in a video call for the front camera to be active.*
Note: *Always use the "troubled" phone when evaluating a picture in a video call. Do not evaluate the picture on the receiving phone.*
Secondary camera failure
Check that camera module **flex is properly fixed** in connector
NO
Fix camera properly. Is camera working now?
YES
NO
YES
Check **X3350 solder joints** and **spring contacts**. OK?
NO
Replace **X3350** or **C-cover assembly.** Is camera working now?
YES
NO
YES
Replace **camera module** or **C-cover assembly.** Is camera working now?
NO
Go to *"Secondary camera hardware troubleshooting"*
YES
YES
End

Secondary camera hardware troubleshooting

Troubleshooting flow

Note: *Phone must be in a video call for the secondary camera to be active with signals and voltages present.*

Note: *Always use the "troubled" phone when evaluating a picture in a video call. Do not evaluate the picture on the receiving phone.*


Measure **EXTCLK over R1413: 25.6 MHz Nominal amplitude 1.8V (+/-0.13V)**?
No
Check **R1413**: Is the component in place and of the correct value/type?
No
Change the faulty component. Is the camera working now?
Yes
Yes
No
Measure **VCAM_2V8_LOWRES over C1406: 2.8V (+/-0.13V)**?
No
Check **C1406, C1408** and **L1403**: Are these components in place and of the correct value/type?
No
Change the faulty component(s). Is the camera working now?
Yes
Yes
No
Measure **VCAM_1V8 over C1405: 1.8V (+/-0.13V)**?
No
Check **C1405, C1407** and **L1402:** Are these components in place and of the correct value/type?
No
Change the faulty component(s). Is the camera working now?
Yes
Yes
No
Measure **VCAM_1V5 over C3351: 1.5V (+/-0.13V)**?
No
Check **C3351** and **L3351**: Are these components in place and of the correct value/type?
No
Change the faulty component(s). Is the camera working now?
Yes
Yes
No
Measure **Camera Parallel data Sync VD and HD on R1411 (dual res): nominal amplitude 1.8V (+/- 0.13 V)**?
No
Check **R1411**: Is this component in place and of the correct value/type?
No
Change the faulty component. Is the camera working now?
Yes
Yes
No
Measure **Camera Parallel data Lines on R1410: nominal amplitude 2.8V to 1.8V (+/- 0.13 V)**?
No
Check **R1410**: Are there components in place and of the correct value/type?
No
Change the faulty component. Is the camera working now?
Yes
Yes
No
Replace **C-cover assembly**: Is camera still failing?
Yes
Replace **coax**: Is camera still failing?
Yes
Beyond economical repair

Audio troubleshooting

Audio troubleshooting test instructions

Differential external earpiece and internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

Internal handsfree output is measured using a current probe, if a special low-pass filter designed for measuring a digital amplifier is not available. Note also that when using a current probe, the input signal frequency must be set to 2kHz.

The input signal for each loop test can be either single-ended or differential.

Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- 'Active speaker' or 'speaker and power amplifier'
- Sound level meter
- Current probe (Internal handsfree DPMA output measurement)
- Phoenix service software
- Battery voltage 3.7V

Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths can be activated:

- External microphone to Internal earpiece
- External microphone to Internal handsfree speaker
- Internal microphone to External earpiece

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in the following table.

Phoenix audio loop tests and test results

The results presented in the table apply when no accessory is connected and battery voltage is set to 3.7V.

Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

The gain values presented in the table apply for a differential output vs. single-ended/differential input.

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to External Earpiece	XMICP and GND	HSEAR R P, HSEAR R N and GND	-2.9	1000	720	1.2	NA
		HSEAR P, HSEAR N and GND					
	XMICN and GND	HSEAR R P, HSEAR R N and GND					
		HSEAR P, HSEAR N and GND					
External Mic to Internal Earpiece	XMICP and GND	EarP and GND	-4.5	1000	600	1.2	NA
		EarN and GND					
	XMICN and GND	EarP and GND					
		EarN and GND					
External Mic to Internal handsfree	XMICP and GND	B2102 pads	-5	1000	560	0	25mA (calc.)
	XMICN and GND	B2102 pads					
Internal Mic to External Earpiece	B2100 (OUT/GND)	HSEAR R P, HSEAR R N and GND	22.7	100	1360	1.2	NA
		HSEAR P, HSEAR N and GND					
		HSEAR R P, HSEAR R N and GND					
		HSEAR P, HSEAR N and GND					

Measurement data

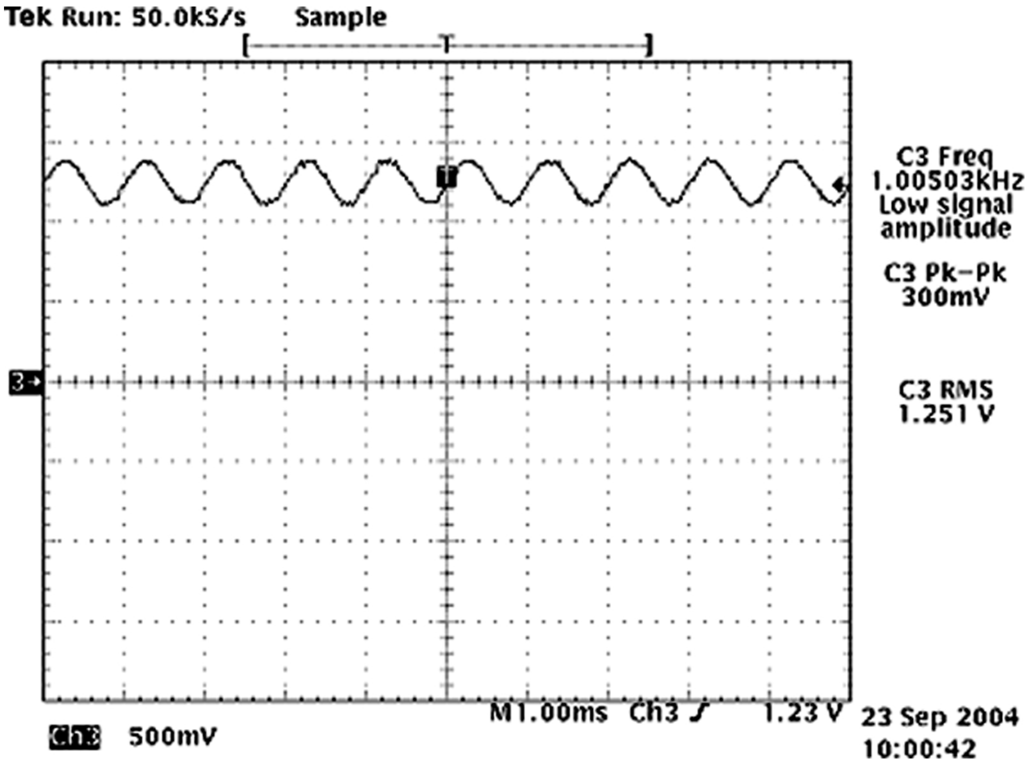
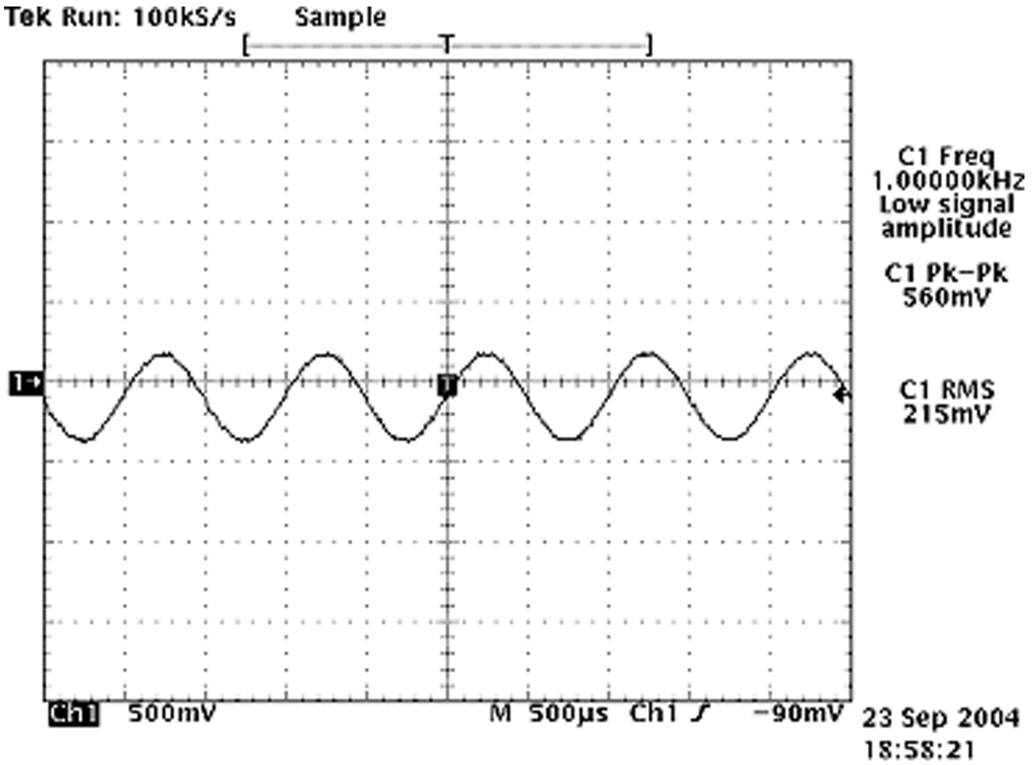


Figure 10 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.



If a special low-pass filter designed for measuring digital amplifiers is unavailable, the measurement must be performed with a current probe and the input signal frequency must be 2kHz.

Figure 11 Differential output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected.

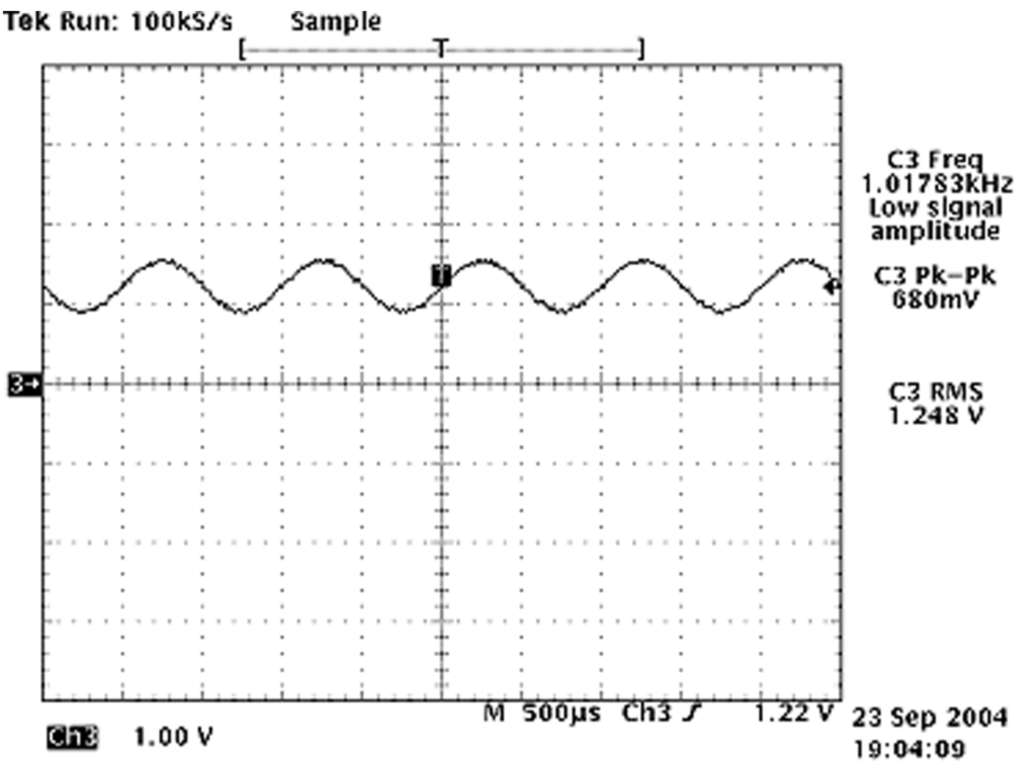
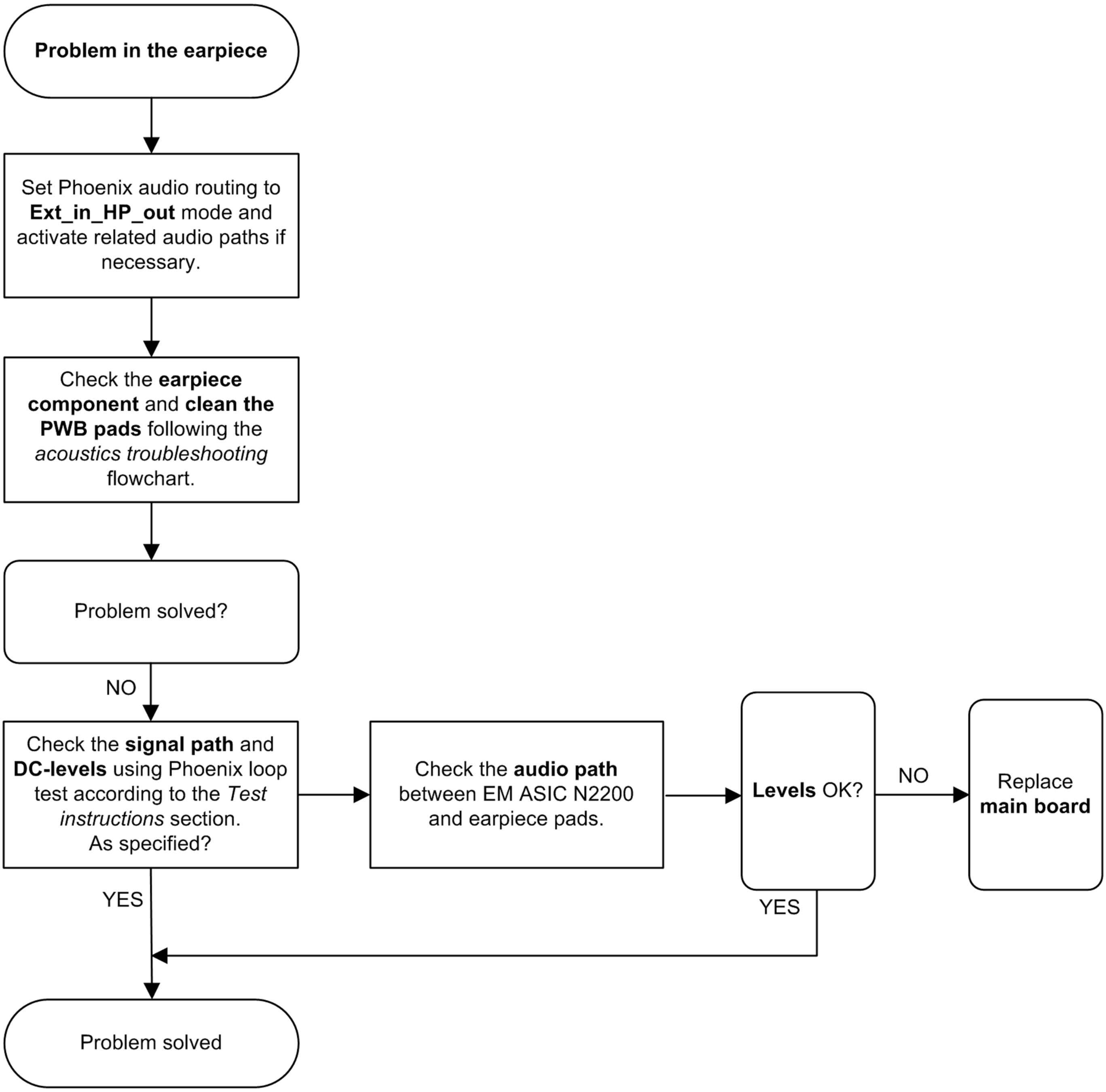


Figure 12 Single-ended output waveform of the HP_in_Ext_out loop when microphone is connected.

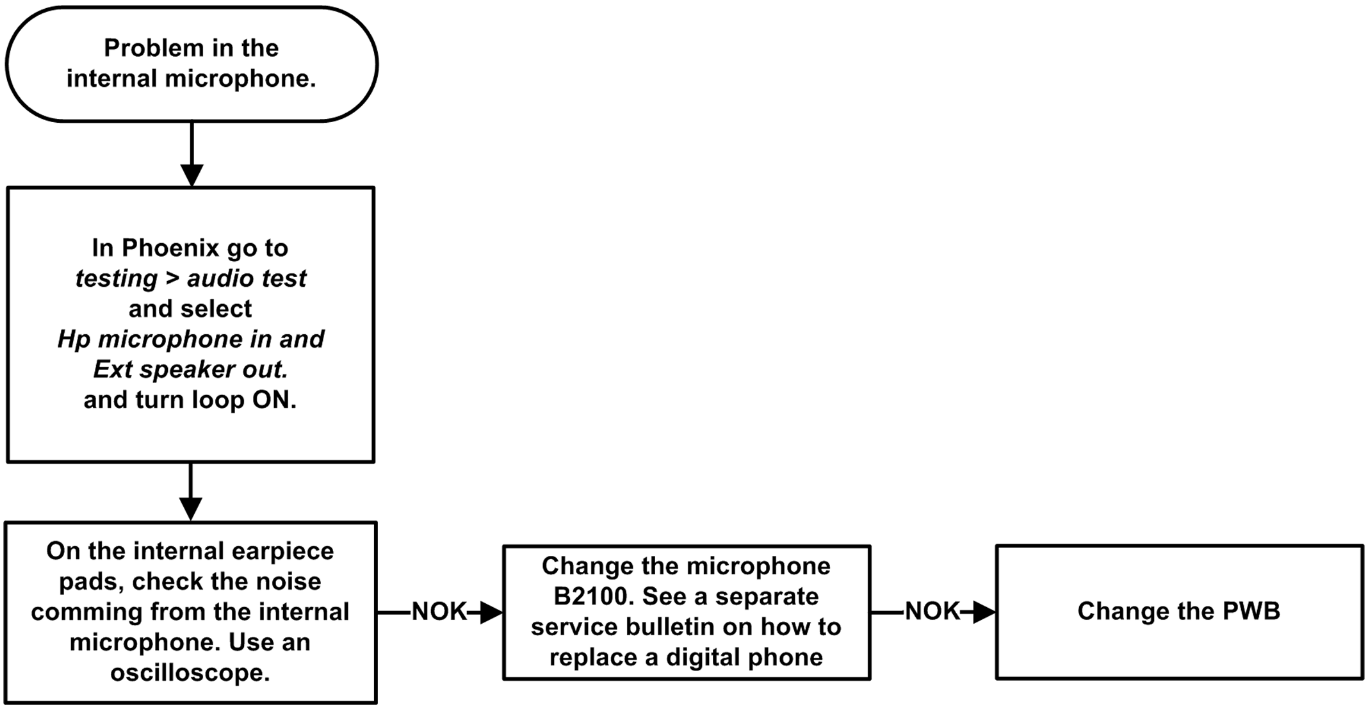
Internal earpiece troubleshooting

Troubleshooting flow


Problem in the earpiece
Set Phoenix audio routing to **Ext_in_HP_out** mode and activate related audio paths if necessary.
Check the **earpiece component** and **clean the PWB pads** following the *acoustics troubleshooting* flowchart.
Problem solved?
NO
Check the **signal path** and **DC-levels** using Phoenix loop test according to the *Test instructions* section. As specified?
Check the **audio path** between EM ASIC N2200 and earpiece pads.
Levels OK?
NO
Replace **main board**
YES
YES
Problem solved

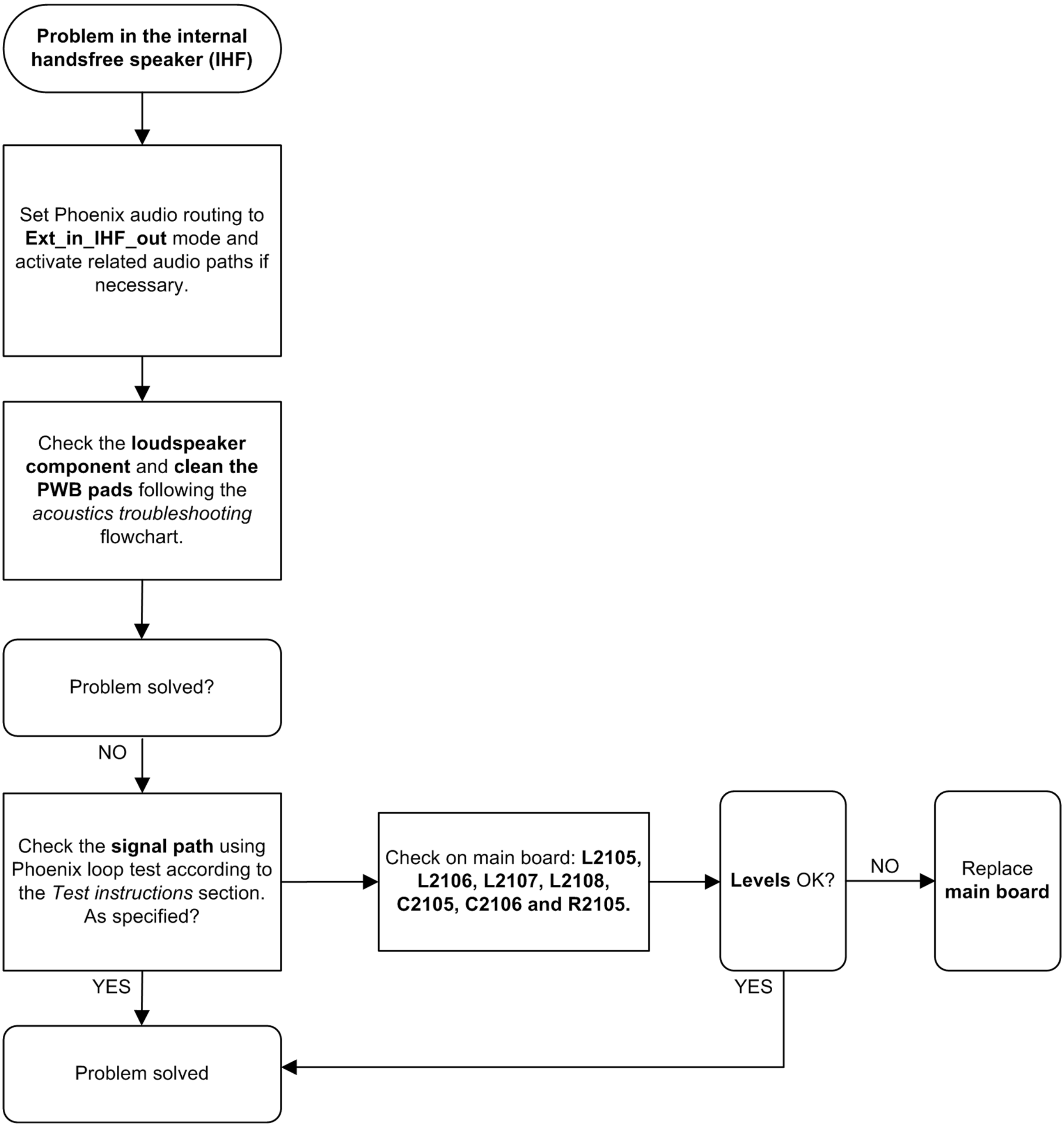
Internal microphone troubleshooting

Troubleshooting flow


Problem in the internal microphone.
In Phoenix go to *testing > audio test* and select *Hp microphone in and Ext speaker out.* and turn loop ON.
On the internal earpiece pads, check the noise comming from the internal microphone. Use an oscilloscope.
NOK
Change the microphone B2100. See a separate service bulletin on how to replace a digital phone
NOK
Change the PWB

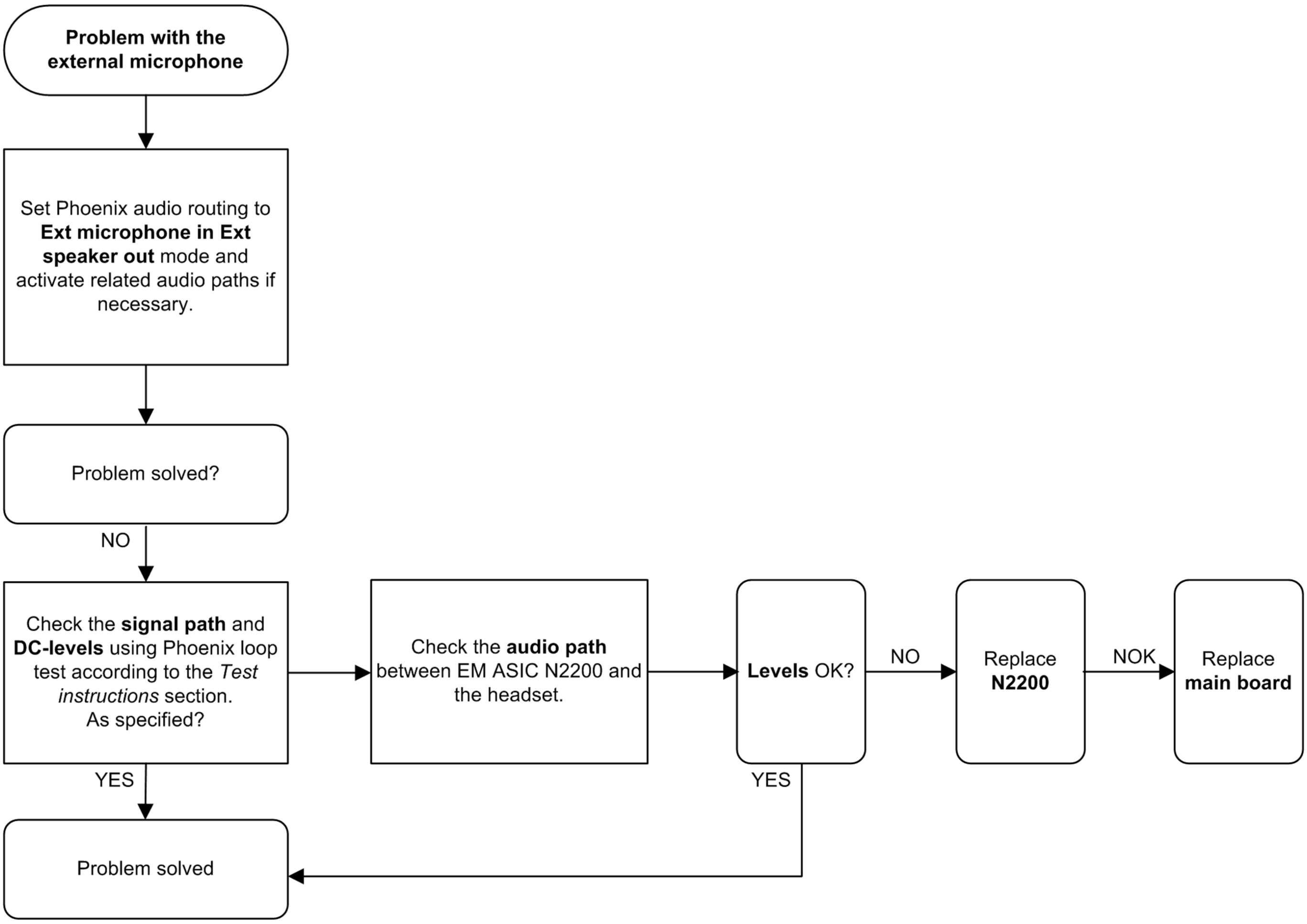
Internal handsfree (IHF) troubleshooting

Troubleshooting flow


Problem in the internal handsfree speaker (IHF)
Set Phoenix audio routing to Ext_in_IHF_out mode and activate related audio paths if necessary.
Check the loudspeaker component and clean the PWB pads following the acoustics troubleshooting flowchart.
Problem solved?
NO
Check the signal path using Phoenix loop test according to the Test instructions section. As specified?
Check on main board: L2105, L2106, L2107, L2108, C2105, C2106 and R2105.
Levels OK?
NO
Replace main board
YES
YES
Problem solved

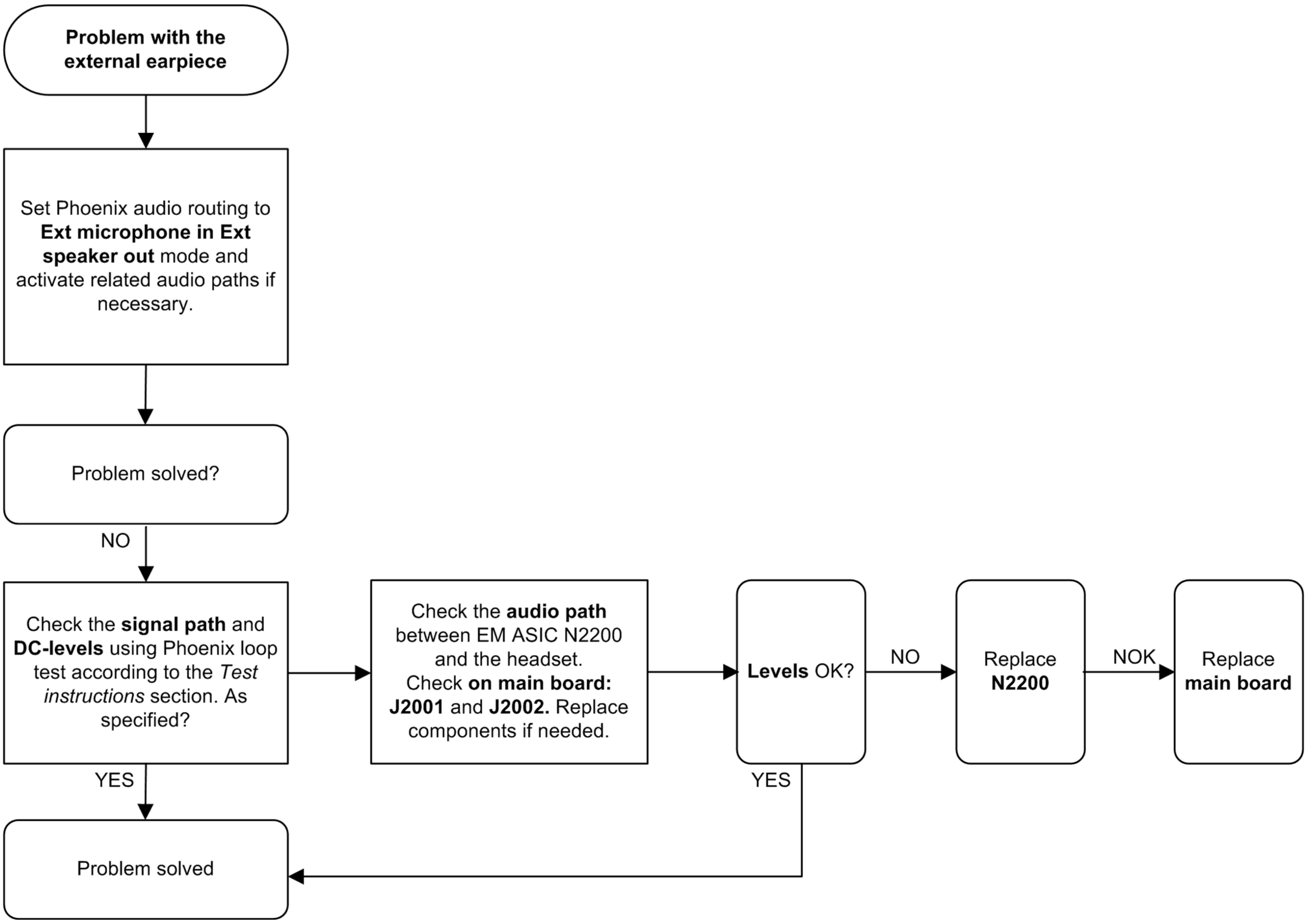
External microphone troubleshooting

Troubleshooting flow


Problem with the external microphone
Set Phoenix audio routing to Ext microphone in Ext speaker out mode and activate related audio paths if necessary.
Problem solved?
NO
Check the signal path and DC-levels using Phoenix loop test according to the Test instructions section. As specified?
YES
Problem solved
Check the audio path between EM ASIC N2200 and the headset.
Levels OK?
YES
NO
Replace N2200
NOK
Replace main board

External earpiece troubleshooting

Troubleshooting flow


Problem with the external earpiece
Set Phoenix audio routing to Ext microphone in Ext speaker out mode and activate related audio paths if necessary.
Problem solved?
NO
Check the signal path and DC-levels using Phoenix loop test according to the Test instructions section. As specified?
YES
Problem solved
Check the audio path between EM ASIC N2200 and the headset. Check on main board: J2001 and J2002. Replace components if needed.
Levels OK?
YES
NO
Replace N2200
NOK
Replace main board

Acoustics troubleshooting

Introduction to acoustics troubleshooting

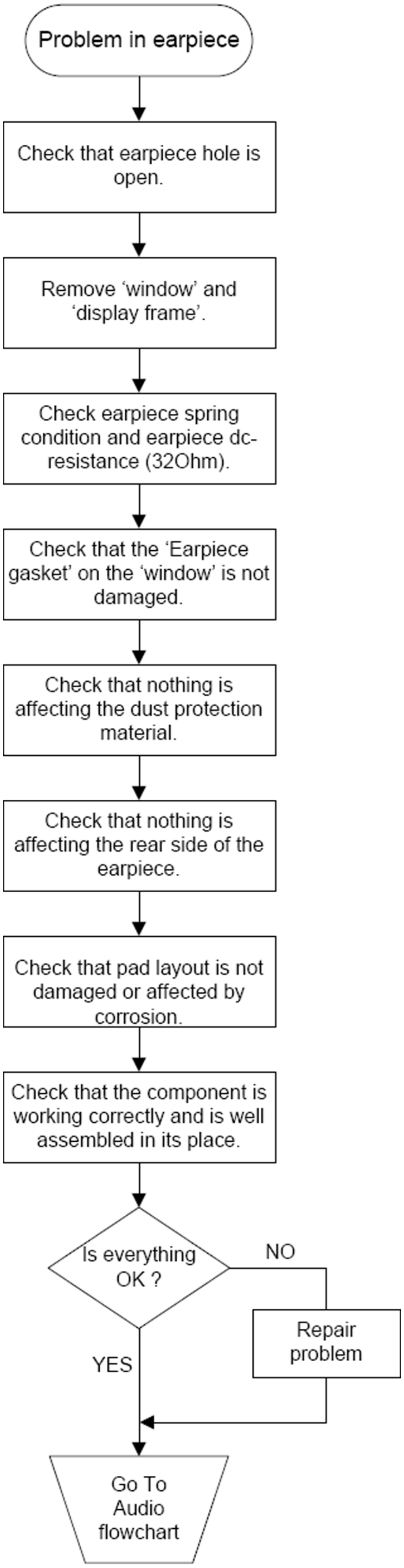
Acoustics design ensures that the sound is detected correctly with a microphone and properly radiated to the outside of the device by the speaker. The acoustics of the phone includes three basic systems: earpiece, Integrated Hands Free (IHF) and microphone.

The sound reproduced from the earpiece readiates through a single hole on the front cover (A-cover). The sound reproduced from the IHF speaker radiates from the sound holes located on the left side of the device. Microphone is located at the bottom, next to the system connector.

For a correct functionality of the phone, all sound holes must be always open. When the phone is used, care must be taken not to close any of those holes with a hand or fingers. The phone should be dry and clean, and no objects must be located in such a way that they close any of the holes.

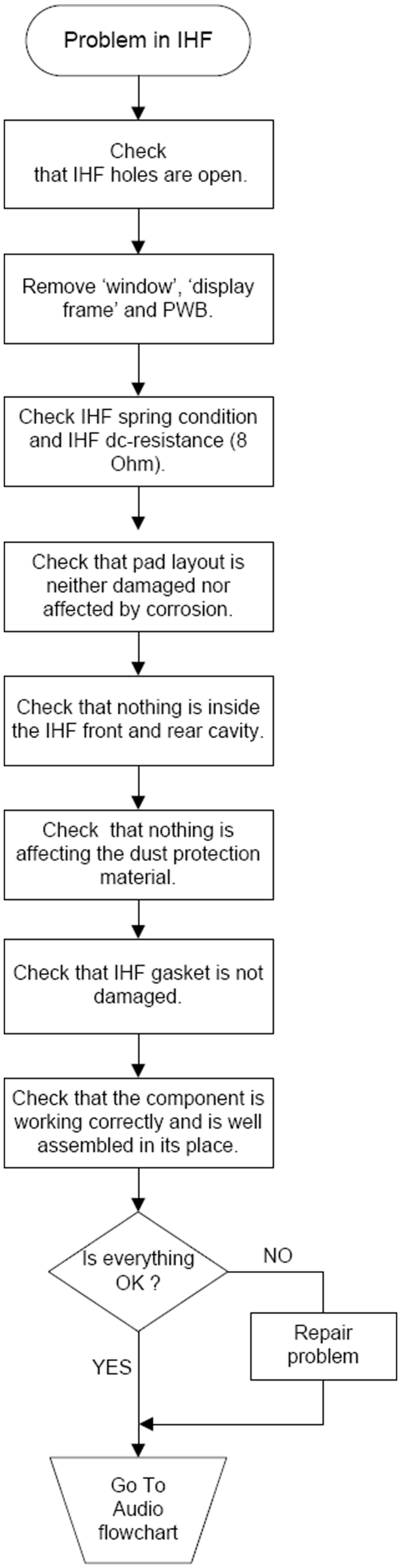
Earpiece troubleshooting

Troubleshooting flow


Problem in earpiece
Check that earpiece hole is open.
Remove 'window' and 'display frame'.
Check earpiece spring condition and earpiece dc-resistance (32Ohm).
Check that the 'Earpiece gasket' on the 'window' is not damaged.
Check that nothing is affecting the dust protection material.
Check that nothing is affecting the rear side of the earpiece.
Check that pad layout is not damaged or affected by corrosion.
Check that the component is working correctly and is well assembled in its place.
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

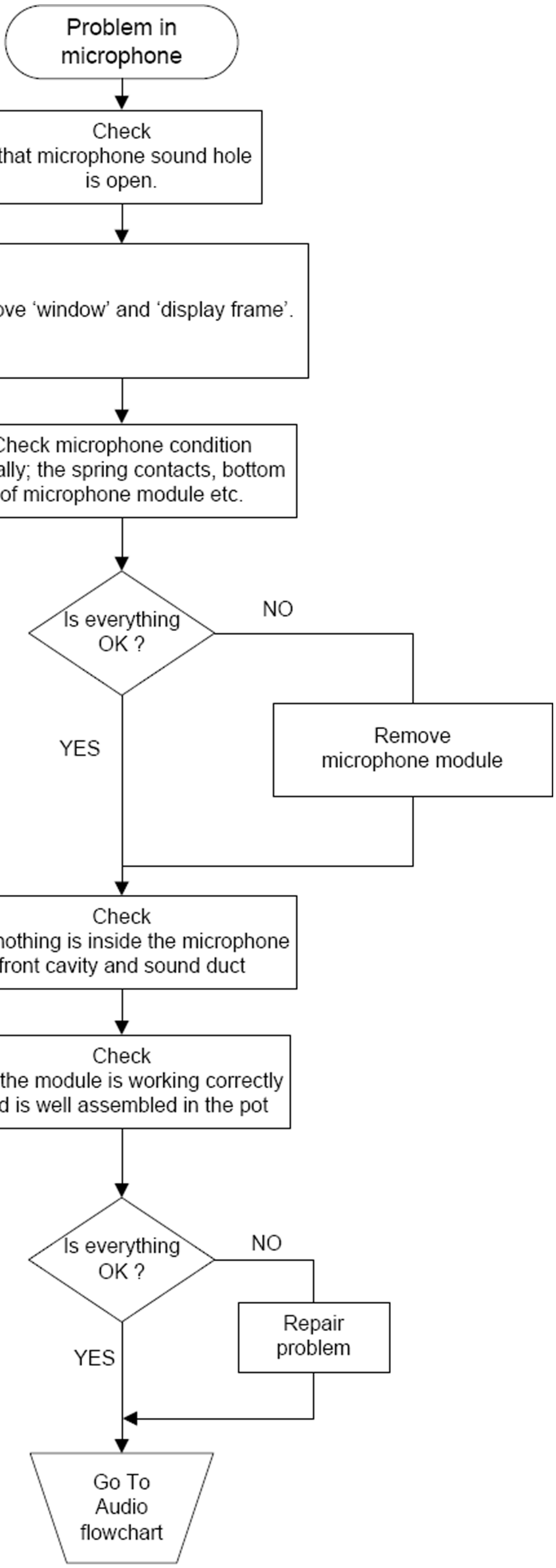
IHF troubleshooting

Troubleshooting flow


Problem in IHF
Check that IHF holes are open.
Remove 'window', 'display frame' and PWB.
Check IHF spring condition and IHF dc-resistance (8 Ohm).
Check that pad layout is neither damaged nor affected by corrosion.
Check that nothing is inside the IHF front and rear cavity.
Check that nothing is affecting the dust protection material.
Check that IHF gasket is not damaged.
Check that the component is working correctly and is well assembled in its place.
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

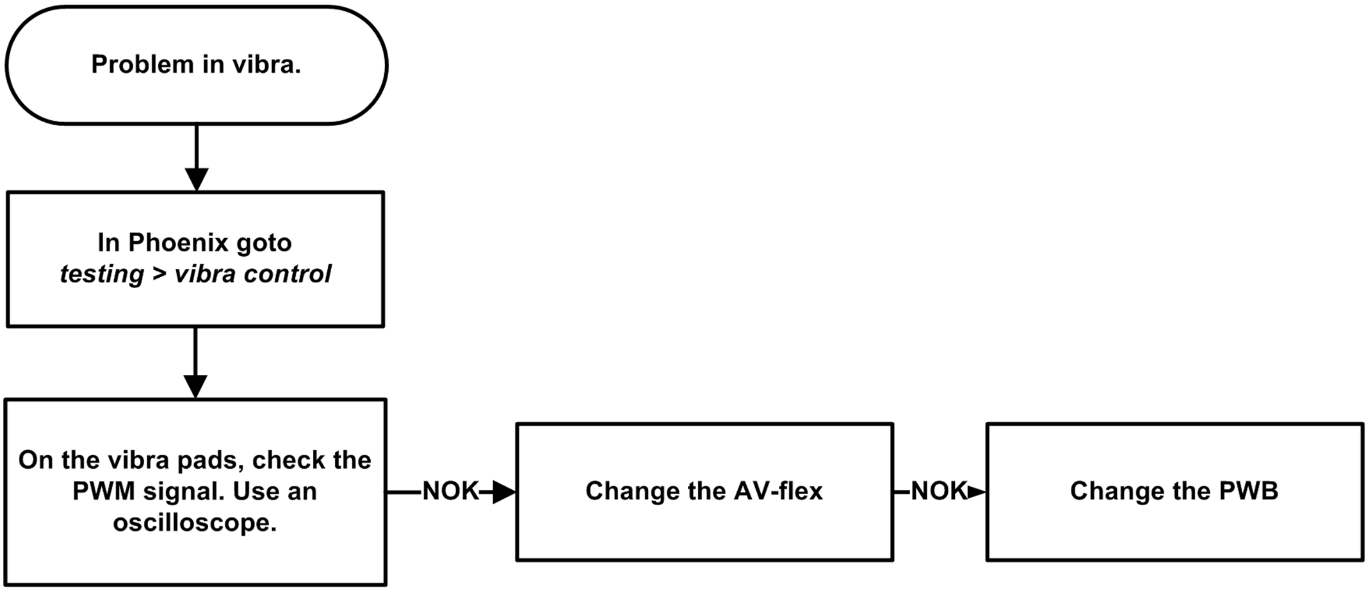
Microphone troubleshooting

Troubleshooting flow


Problem in microphone
Check that microphone sound hole is open.
Remove 'window' and 'display frame'.
Check microphone condition visually; the spring contacts, bottom of microphone module etc.
Is everything OK ?
NO
Remove microphone module
YES
Check that nothing is inside the microphone front cavity and sound duct
Check that the module is working correctly and is well assembled in the pot
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

Vibra troubleshooting

Troubleshooting flow


Problem in vibra.
In Phoenix goto *testing > vibra control*
On the vibra pads, check the PWM signal. Use an oscilloscope.
NOK
Change the AV-flex
NOK
Change the PWB

NFC troubleshooting

Introduction to NFC troubleshooting

If there are defective or missing components on the NFC Module board, the entire board will have to be replaced.

> **Note:** Do not flash operator specific software only for testing! After replacing the NFC Module board, initialization/formatting of the smart MX component can only be done once.

Perform the NFC troubleshooting in the following order:

1 Tag reading
2 Visual inspection
3 Selftests
4 Follow the NFC troubleshooting diagram (only for Repair Analysis)

NFC troubleshooting for service

Steps

1. **Tag reading**
   - i Place the tag on any non-conductive material (eg. glass, plastic, wood).

     > **Note:** Do not place tags on metal or other conductive surfaces, as it may prevent the reader from being able to read the tags.
   - ii Touch the tag with the phone, like shown in figure "NFC tag detection". Repeat 3-4 times.

     > **Note:** Remember to set **Tag Detection ON** (go to **Active standby** and select **Tag Detection ON**) For further instructions, please refer to the User Guide on the Nokia web site (http://www.nokia.com).

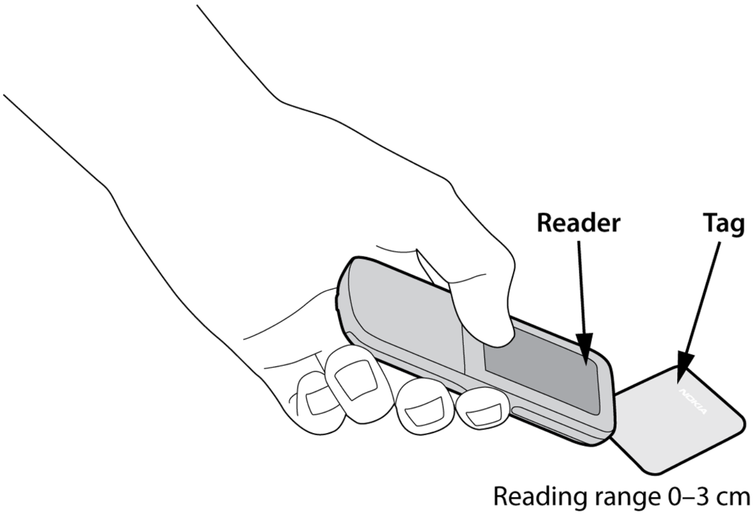

Reader
Tag
Reading range 0–3 cm

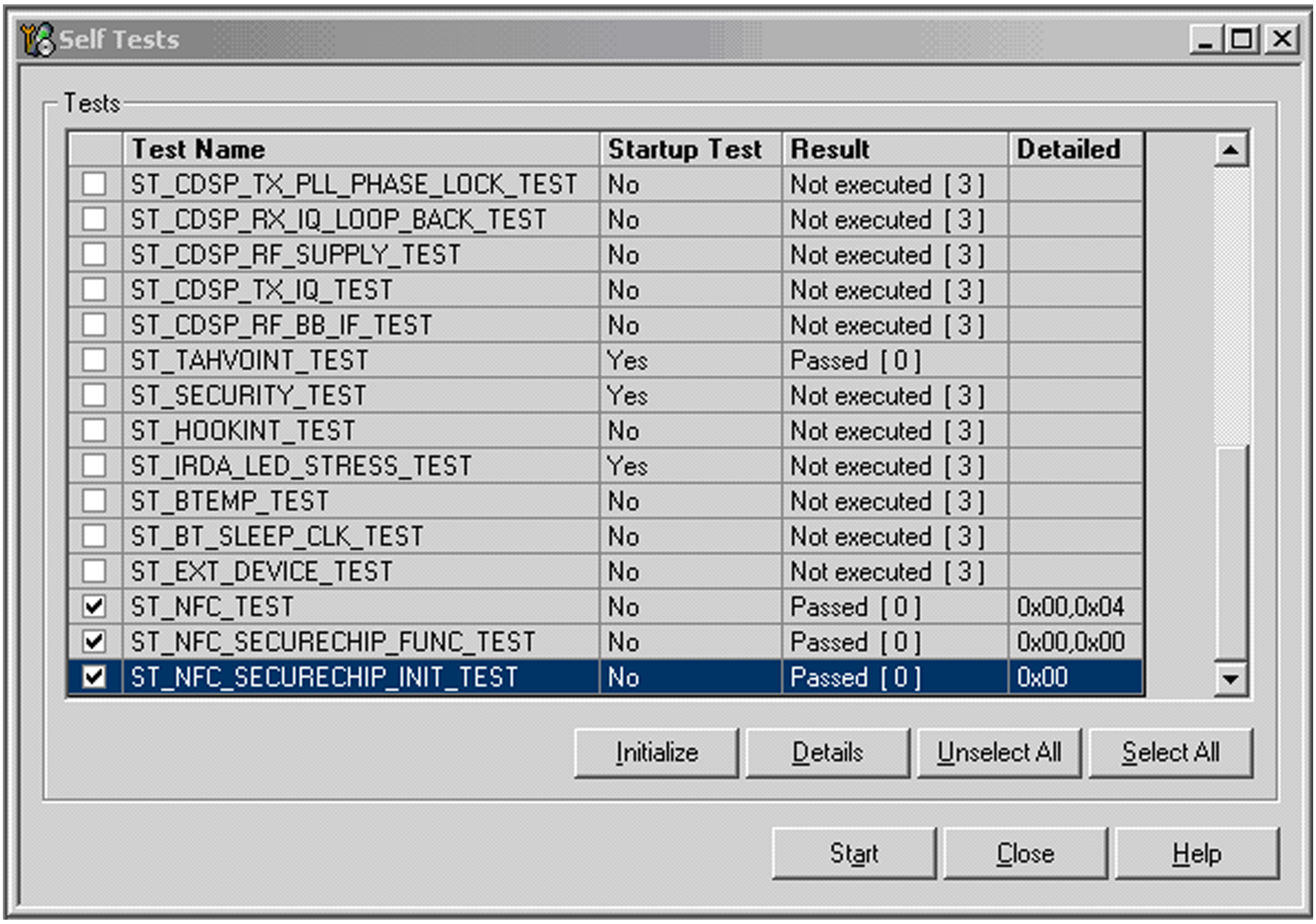
Figure 13 NFC tag detection

If OK continue with visual inspection.

If NOK replace NFC Module board.

2. **Selftests**

   Run **NFC_TEST** by using Phoenix.


Self Tests
Tests
Initialize
Details
Unselect All
Select All
Start
Close
Help

	Test Name	Startup Test	Result	Detailed
☐	ST_CDSP_TX_PLL_PHASE_LOCK_TEST	No	Not executed [3]	
☐	ST_CDSP_RX_IQ_LOOP_BACK_TEST	No	Not executed [3]	
☐	ST_CDSP_RF_SUPPLY_TEST	No	Not executed [3]	
☐	ST_CDSP_TX_IQ_TEST	No	Not executed [3]	
☐	ST_CDSP_RF_BB_IF_TEST	No	Not executed [3]	
☐	ST_TAHVOINT_TEST	Yes	Passed [0]	
☐	ST_SECURITY_TEST	Yes	Not executed [3]	
☐	ST_HOOKINT_TEST	No	Not executed [3]	
☐	ST_IRDA_LED_STRESS_TEST	Yes	Not executed [3]	
☐	ST_BTEMP_TEST	No	Not executed [3]	
☐	ST_BT_SLEEP_CLK_TEST	No	Not executed [3]	
☐	ST_EXT_DEVICE_TEST	No	Not executed [3]	
☑	ST_NFC_TEST	No	Passed [0]	0x00,0x04
☑	ST_NFC_SECURECHIP_FUNC_TEST	No	Passed [0]	0x00,0x00
☑	ST_NFC_SECURECHIP_INIT_TEST	No	Passed [0]	0x00

Figure 14 NFC selftest in Phoenix

<table>
<tr><th colspan="2">ST_NFC_TEST</th></tr>
<tr><td colspan="2">Contains <i>two tests</i>; one for verifying NFC chipset functionality, and one for verifying tag reading functionality. The tag reading test result can only be seen in the Phoenix details. This is done in normal production, as there are no tags in the production line for verifying test success. Tag reading is a manual test case.</td></tr>
<tr><td>Return values:</td><td>PASS - NFC Self tests passed
FAIL - NFC self test failed (at least one)
Note: The tag reading test fails if there is no tag on field – in these cases the result of complete NFC_test is Passed.</td></tr>
<tr><td>Tests bits used in test details:</td><td>Bit 0x01 set when NFC Chip self tests fails
Bit 0x04 set when Tag read test fails (this do not occur fail)</td></tr>
</table>

<table>
<tr><th colspan="2">ST_NFC_SECURECHIP_FUNC_TEST</th></tr>
<tr><td colspan="2">Contains <i>two tests</i> for verifying secure element chip functionality. The secure element state in the phone is verified by checking if a secure element is present, and if its serial number can be read
Note: This test ignores whether the key population is done (like phones coming from factory) or not (like spare NFC Module boards before key population). Fail means always that Secure Element is not working properly.</td></tr>
<tr><td>Return values:</td><td>PASS - Secure element is functional and responds to commands
FAIL - Secure element does not respond to commands (either test fails)</td></tr>
<tr><td>Tests bits used in test details:</td><td>Bit 0x01 set when NFC Chip self tests fails
Bit 0x04 set when Tag read test fails (this do not occur fail)</td></tr>
</table>

<table>
<tr><th colspan="2">ST_NFC_SECURECHIP_INIT_TEST</th></tr>
<tr><td colspan="2">This test case checks if secure element key population has been done. Key population is done by using the pre stored key population data in the MCUSW content package. When this key population data has been present and key population has done successfully this test return PASS.
Note: This test will only tell that if key population is done or not – if this test fails it does not necessarily mean that secure element is defected (like if phone is not meant to be used for payment & ticketing purposes).</td></tr>
<tr><td>Return values:</td><td>PASS - Secure element key population has been done OK
FAIL - Secure element key population is not done</td></tr>
<tr><td>Tests bits used in test details:</td><td>Bit 0x10 is set in when SE key population has not been done</td></tr>
</table>

For **service**: If NOK replace NFC Module board.

For **repair analysis**: If OK follow the NFC troubleshooting diagram

3. **Visual inspection**

Check visually that there are no open pads in the NFC Antenna connector board solderings.

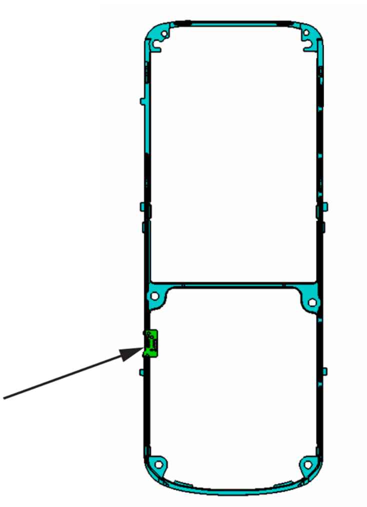


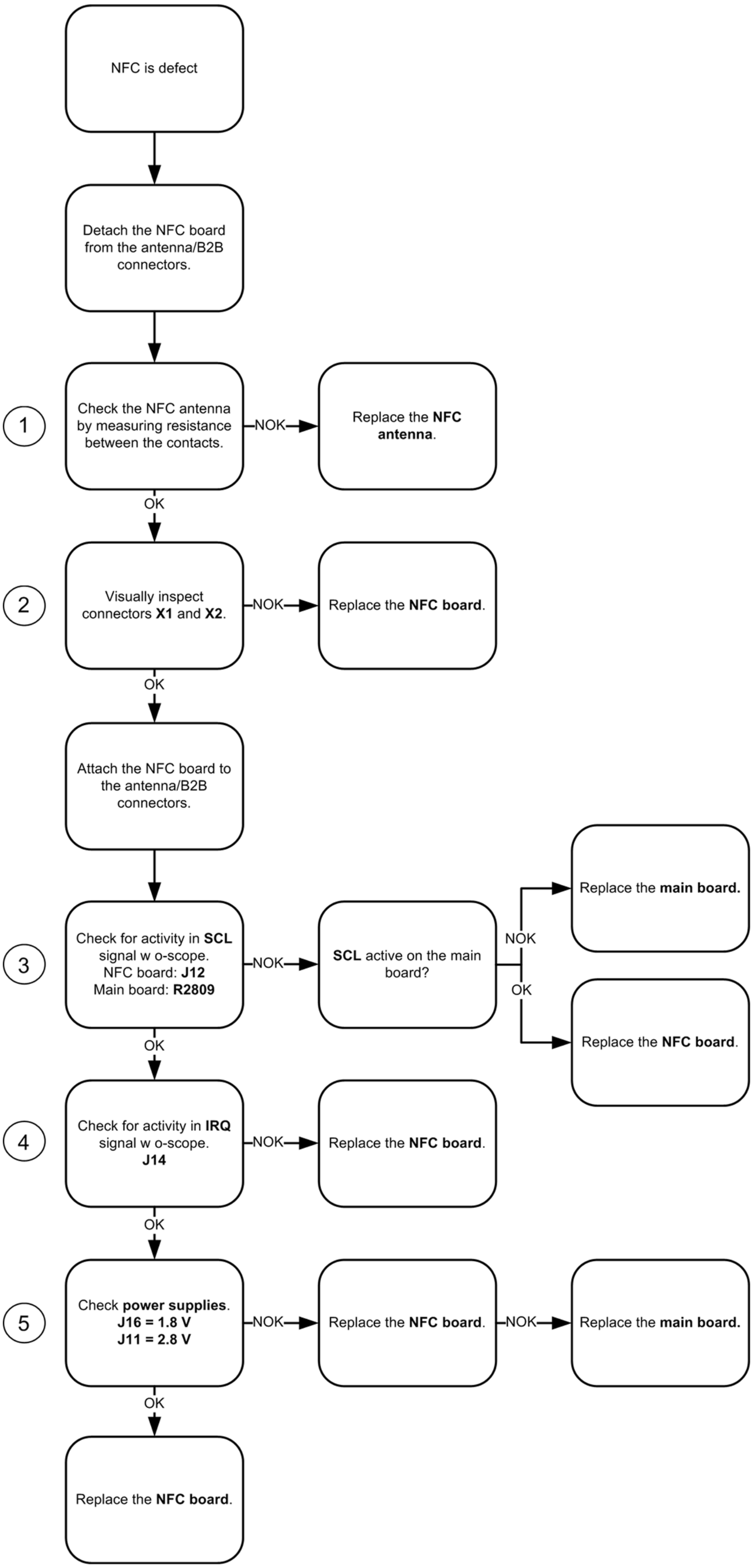
Figure 15 NFC board connector soldering

For **service**: If NOK replace NFC Antenna Module.

For **repair analysis**: If OK go to the *NFC troubleshooting for repair analysis*.

NFC troubleshooting for repair analysis

Troubleshooting flow


NFC is defect
Detach the NFC board from the antenna/B2B connectors.
1
Check the NFC antenna by measuring resistance between the contacts.
NOK
Replace the **NFC antenna**.
OK
2
Visually inspect connectors **X1** and **X2**.
NOK
Replace the **NFC board**.
OK
Attach the NFC board to the antenna/B2B connectors.
3
Check for activity in **SCL** signal w o-scope.
NFC board: **J12**
Main board: **R2809**
NOK
SCL active on the main board?
NOK
Replace the **main board.**
OK
Replace the **NFC board**.
OK
4
Check for activity in **IRQ** signal w o-scope.
J14
NOK
Replace the **NFC board**.
OK
5
Check **power supplies**.
J16 = 1.8 V
J11 = 2.8 V
NOK
Replace the **NFC board**.
NOK
Replace the **main board.**
OK
Replace the **NFC board**.

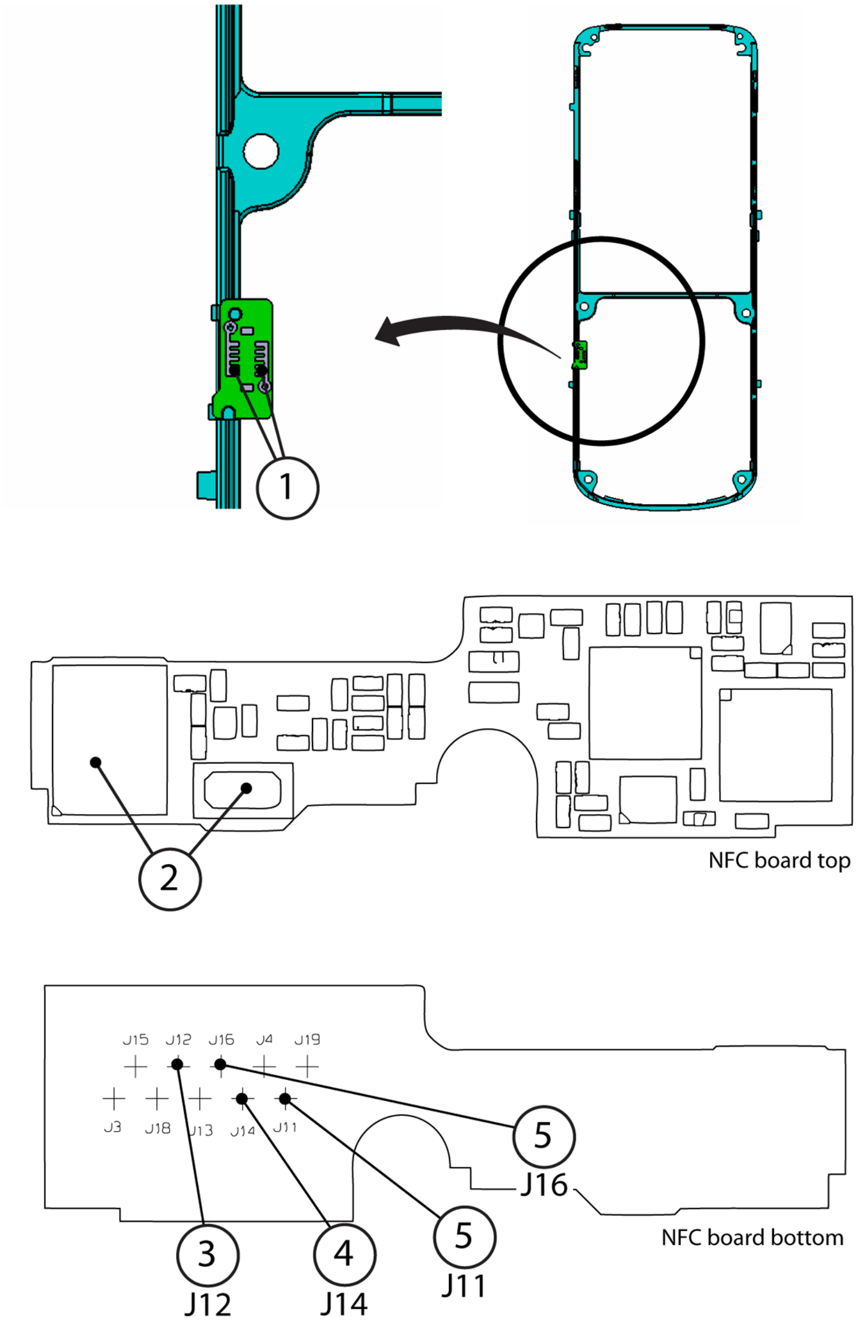

1
2
NFC board top
J15
J12
J16
J4
J19
J3
J18
J13
J14
J11
5
J16
NFC board bottom
3
J12
4
J14
5
J11

Figure 16 NFC troubleshooting testpoints

Baseband manual tuning guide

Certificate restoring for BB5 products

Context

This procedure is performed when the device certificate is corrupted for some reason.

All tunings (RF & Baseband, UI) must be done after performing the certificate restoring procedure.

The procedure for certificate restoring is the following:

- Flash the phone with the latest available software using FPS-8 or FPS-10.

  Note: USB flashing does not work for a dead BB5 phone.

- Create a request file.
- Send the file to Nokia by e-mail. Use the following addresses depending on your location:
  - APAC: sydney.service@nokia.com
  - CHINA: repair.ams@nokia.com
  - E&A: salo.repair@nokia.com
  - AMERICAS: fls1.usa@nokia.com
- When you receive a reply from Nokia, carry out certificate restoring.
- Tune the phone completely.

  Note: SX-4 smart card is needed.
- If the phone resets after certificate restoring, reflash the phone again.

Required equipment and setup:

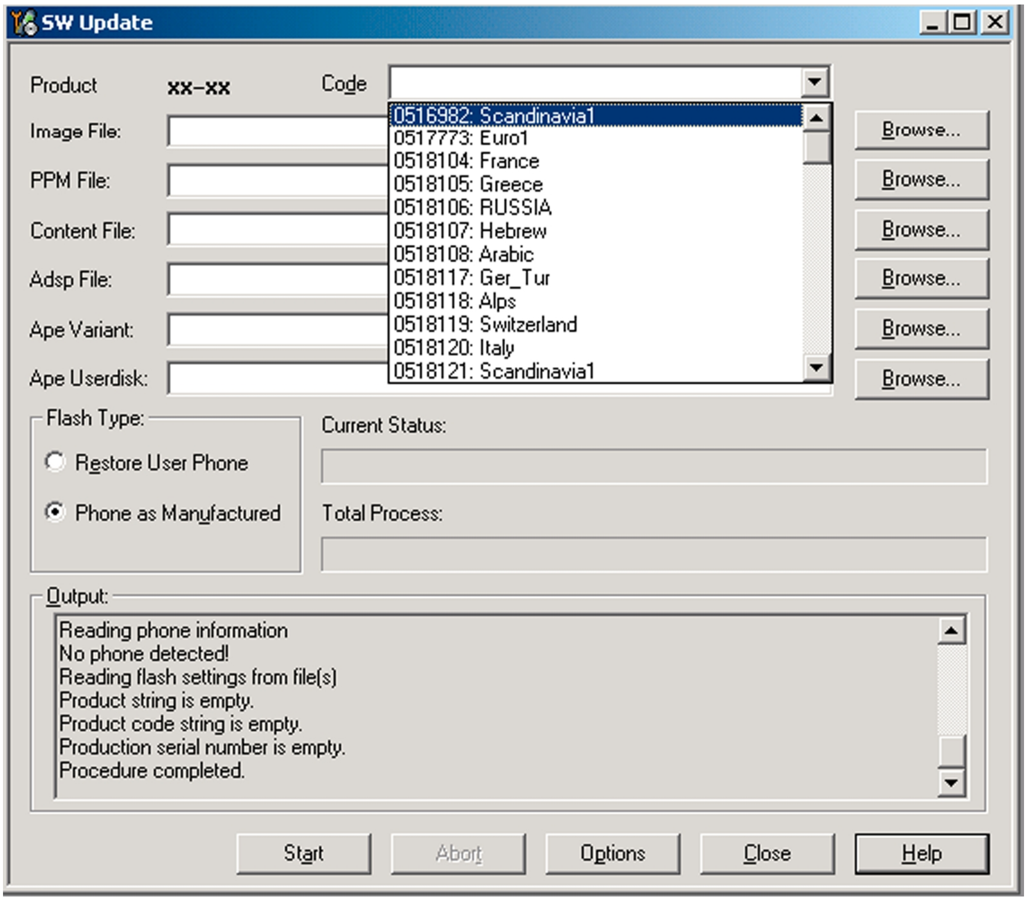
- *Phoenix* service software v 2007.19 or newer.
- The latest phone model specific *Phoenix* data package.
- PKD-1 dongle
- SX-4 smart card (Enables BB5 testing and tuning features)
- External smart card reader

  Note: The smart card reader is only needed when FPS-8 is used. FPS-10 has an integrated smart card reader.
- Activated FPS-8 flash prommer **OR** FPS-10 flash prommer
- Flash update package 03.18.004 or newer for FPS-8 or FPS-10 flash prommers
- CU-4 control unit
- USB cable from PC USB Port to CU-4 control unit
- Phone model specific adapter for CU-4 control unit
- PCS-1 cable to power CU-4 from external power supply
- XCS-4 modular cable between flash prommer and CU-4

  Note: CU-4 must be supplied with +12 V from an external power supply in all steps of certificate restoring.

Steps

1. Program the phone software.
   i Start *Phoenix* and login. Make sure the connection has been managed correctly for FPS-8 or FPS-10.
   ii Update the phone MCU software to the latest available version.
   If the new flash is empty and the phone cannot communicate with *Phoenix*, reflash the phone.
   iii Choose the product manually from **File→Open Product** , and click **OK**.
   Wait for the phone type designator (e.g. “RM-1”) to be displayed in the status bar.
   iv Go to **Flashing→SW Update** and wait until *Phoenix* reads the product data as shown in the following picture.



SW Update
Image File:
PPM File:
Content File:
Adsp File:
Ape Variant:
Ape Userdisk:
0516982: Scandinavia1
0517773: Euro1
0518104: France
0518105: Greece
0518106: RUSSIA
0518107: Hebrew
0518108: Arabic
0518117: Ger_Tur
0518118: Alps
0518119: Switzerland
0518120: Italy
0518121: Scandinavia1
Browse...
Current Status:
Total Process:
Start
Abort
Options
Close
Help

Product xx-xx

Code

Flash Type:
○ Restore User Phone
● Phone as Manufactured

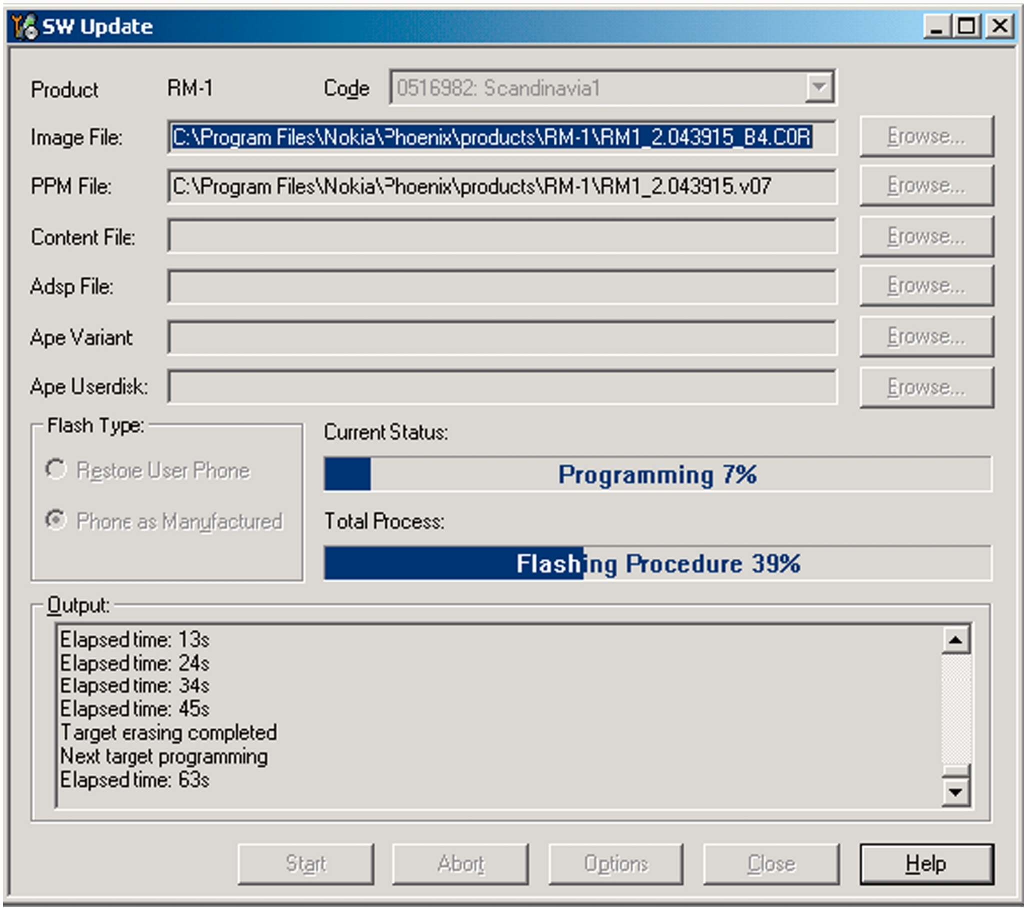
Output:

```
Reading phone information
No phone detected!
Reading flash settings from file(s)
Product string is empty.
Product code string is empty.
Production serial number is empty.
Procedure completed.
```

Product	is automatically set according to the phone support module which was opened manually, but the flash files cannot be found because the correct data cannot be read from the phone automatically.
Code	must be chosen manually, it determines the correct flash files to be used. Please choose the correct product code (can be seen in the phone type label) from the dropdown list.
Flash Type	must be set to **Phone as Manufactured**.

- To continue, click **Start**.

  Progress bars and messages on the screen show actions during phone programming, please wait.



Product: RM-1

Code: 0516982: Scandinavia1

Image File: C:\Program Files\Nokia\Phoenix\products\RM-1\RM1_2.043915_B4.C0R

PPM File: C:\Program Files\Nokia\Phoenix\products\RM-1\RM1_2.043915.v07

Content File:

Adsp File:

Ape Variant

Ape Userdisk:

Flash Type: ○ Restore User Phone ● Phone as Manufactured

Current Status: Programming 7%

Total Process: Flashing Procedure 39%

Output:

```
Elapsed time: 13s
Elapsed time: 24s
Elapsed time: 34s
Elapsed time: 45s
Target erasing completed
Next target programming
Elapsed time: 63s
```

Programming is completed when Flashing Completed message is displayed.

The product type designator and MCU SW version are displayed in the status bar.

vi Close the *SW Update* window and then choose **File→Close Product** .

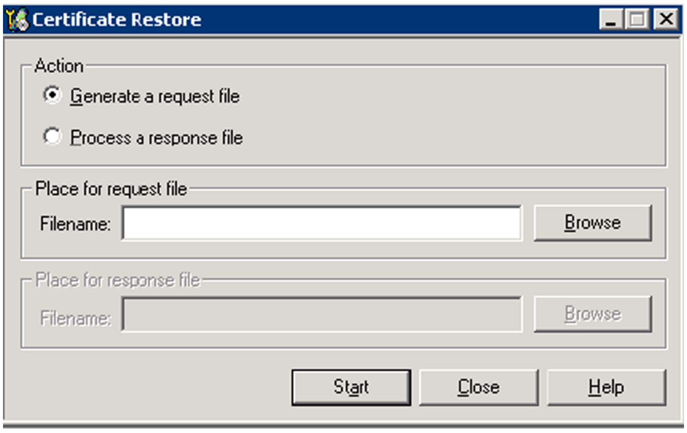
2. Create a *Request* file.

For this procedure, you must supply +12 V to CU-4 from an external power supply.

i To connect the phone with *Phoenix*, choose **File→Scan Product** .

ii Choose **Tools→Certificate Restore** .

iii To choose a location for the request file, click **Browse**.



Action

● Generate a request file

○ Process a response file

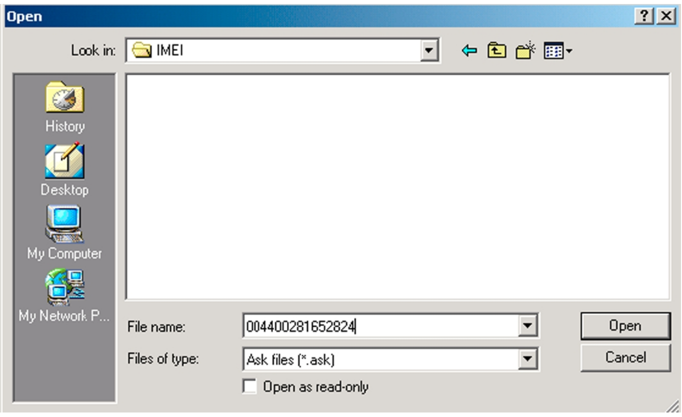
Place for request file

Filename:

Place for response file

Filename:

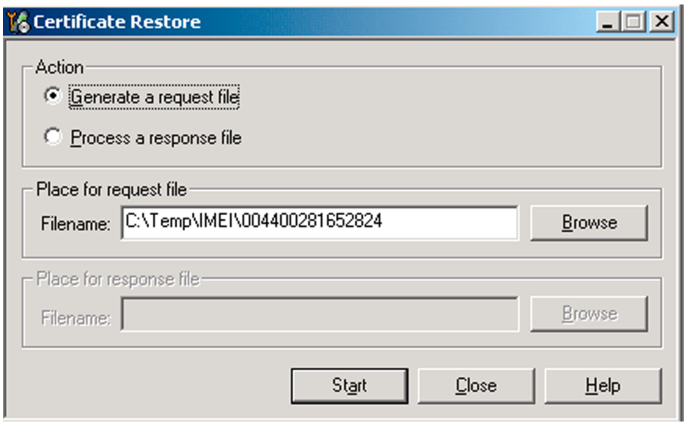
iv Name the file so that you can easily identify it, and click **Open**.


Open
Look in:
IMEI
History
Desktop
My Computer
My Network P...
Open
Cancel
Open as read-only

File name: 004400281652824

Files of type: Ask files (*.ask)

The name of the file and its location are shown.


Certificate Restore
Action
Process a response file
Place for response file
Filename:
Browse
Browse
Start
Close
Help

● Generate a request file

Place for request file

Filename: C:\Temp\IMEI\004400281652824

v To create the *Request* file, click **Start**.

vi When the file for certificate restore has been created, send it to Nokia as an e-mail attachment.

3. Restore certificate.

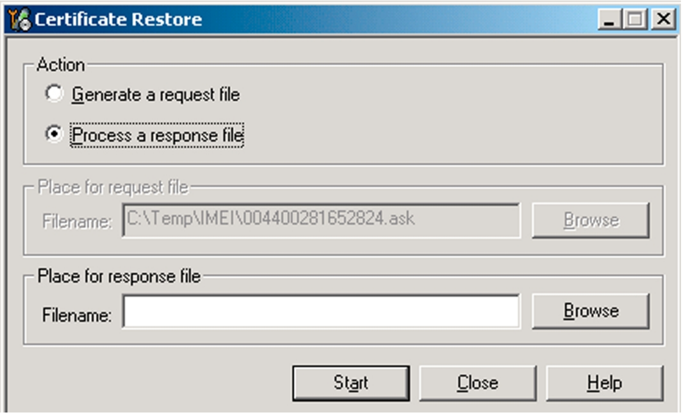
For this procedure, you must supply +12 V to CU-4 from an external power supply.

i Save the reply file sent by Nokia to your computer.

ii Start *Phoenix* service software.

iii Choose **File→Scan Product** .

iv From the **Tools** menu, choose **Certificate Restore** and select **Process a response file** in the *Action* pane.



Certificate Restore

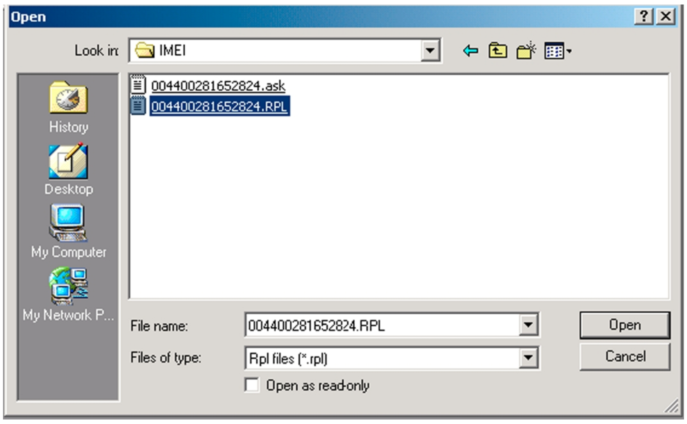
Action
○ Generate a request file
● Process a response file

Place for request file
Filename: C:\Temp\IMEI\004400281652824.ask

Place for response file
Filename:

v To choose the location where response file is saved, click **Browse**.

vi Click **Open**.



Open

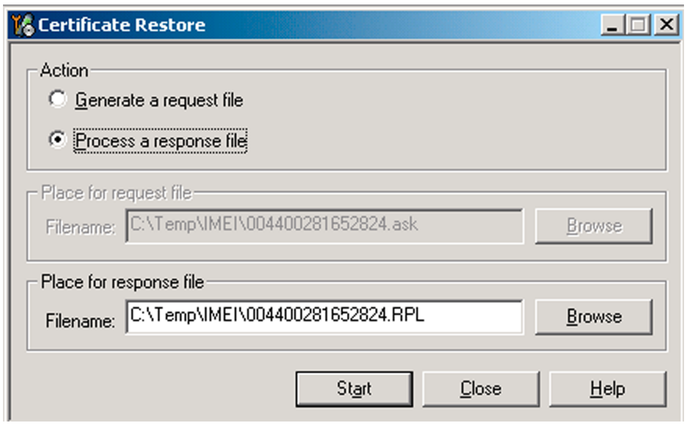
Look in: IMEI

004400281652824.ask
004400281652824.RPL

File name: 004400281652824.RPL
Files of type: Rpl files (*.rpl)
☐ Open as read-only

The name of the file and the path where it is located are shown.

vii To write the file to phone, click **Start**.



Certificate Restore

Action
○ Generate a request file
● Process a response file

Place for request file
Filename: C:\Temp\IMEI\004400281652824.ask

Place for response file
Filename: C:\Temp\IMEI\004400281652824.RPL

Next actions

After a successful rewrite, you must retune the phone completely by using *Phoenix* tuning functions.

Important: Perform all tunings: RF, BB, and UI.

Energy management calibration

Prerequisites

Energy Management (EM) calibration is performed to calibrate the setting (gain and offset) of AD converters in several channels (that is, **battery voltage**, **BSI**, **battery current**) to get an accurate AD conversion result.

Hardware setup:

- An external power supply is needed.
- Supply 12V DC from an external power supply to CU-4 to power up the phone.
- The phone must be connected to a CU-4 control unit with a product-specific flash adapter.

Steps

1. Place the phone to the docking station adapter (CU-4 is connected to the adapter).
2. Start *Phoenix* service software.
3. Choose **File**→ **Scan Product.**
4. Choose **Tuning**→**Energy Management Calibration.**
5. To show the current values in the phone memory, click **Read**, and check that communication between the phone and CU-4 works.
6. Check that the **CU-4 used** check box is checked.
7. Select the item(s) to be calibrated.

   Note: ADC calibration has to be performed before other item(s). However, if all calibrations are selected at the same time, there is no need to perform the ADC calibration first.
8. Click **Calibrate**.

   The calibration of the selected item(s) is carried out automatically.

   The candidates for the new calibration values are shown in the *Calculated values* column. If the new calibration values seem to be acceptable (please refer to the following "Calibration value limits" table), click **Write** to store the new calibration values to the phone permanent memory.

Table 9 Calibration value limits

Parameter	Min.	Max.
ADC Offset	-20	20
ADC Gain	12000	14000
BSI Gain	1100	1300
VBAT Offset	2400	2650
VBAT Gain	19000	23000
VCHAR Gain	N/A	N/A
IBAT (ICal) Gain	7750	12250

9. Click **Read**, and confirm that the new calibration values are stored in the phone memory correctly. If the values are not stored to the phone memory, click **Write** and/or repeat the procedure again.
10. To end the procedure, close the *Energy Management Calibration* window.

4 — RF troubleshooting

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Table of Contents

RF self tests in Phoenix 4–5
General RF troubleshooting 4–6
    Introduction to RF troubleshooting 4–6
    RF key components 4–7
    Non-replaceable RF components....4–7
Auto tuning for BB5.0 4–8
General voltage checking 4–9
Receiver troubleshooting 4–11
    Introduction to receiver (RX) troubleshooting....4–11
    GSM RX chain activation for manual measurements/GSM RSSI measurement 4–11
    WCDMA RX chain activation for manual measurement/WCDMA RSSI measurement....4–12
Transmitter troubleshooting 4–14
    General instructions for transmitter (TX) troubleshooting....4–14
    GSM transmitter troubleshooting....4–14
    WCDMA transmitter troubleshooting 4–17
Bluetooth and FM radio troubleshooting 4–18
    Bluetooth troubleshooting 4–18
    FM radio troubleshooting....4–19

List of Figures

Figure 17 RF key components....4–7
Figure 18 Non-replaceable RF components....4–8
Figure 19 Auto tuning concept with CMU200....4–9
Figure 20 General voltage checking test points (main board, top side) 4–10
Figure 21 RX Control window with example settings 4–13
Figure 22 Typical readings 4–16
Figure 23 Troubleshooting diagram: Bluetooth....4–18
Figure 24 Troubleshooting diagram: FM radio 4–19

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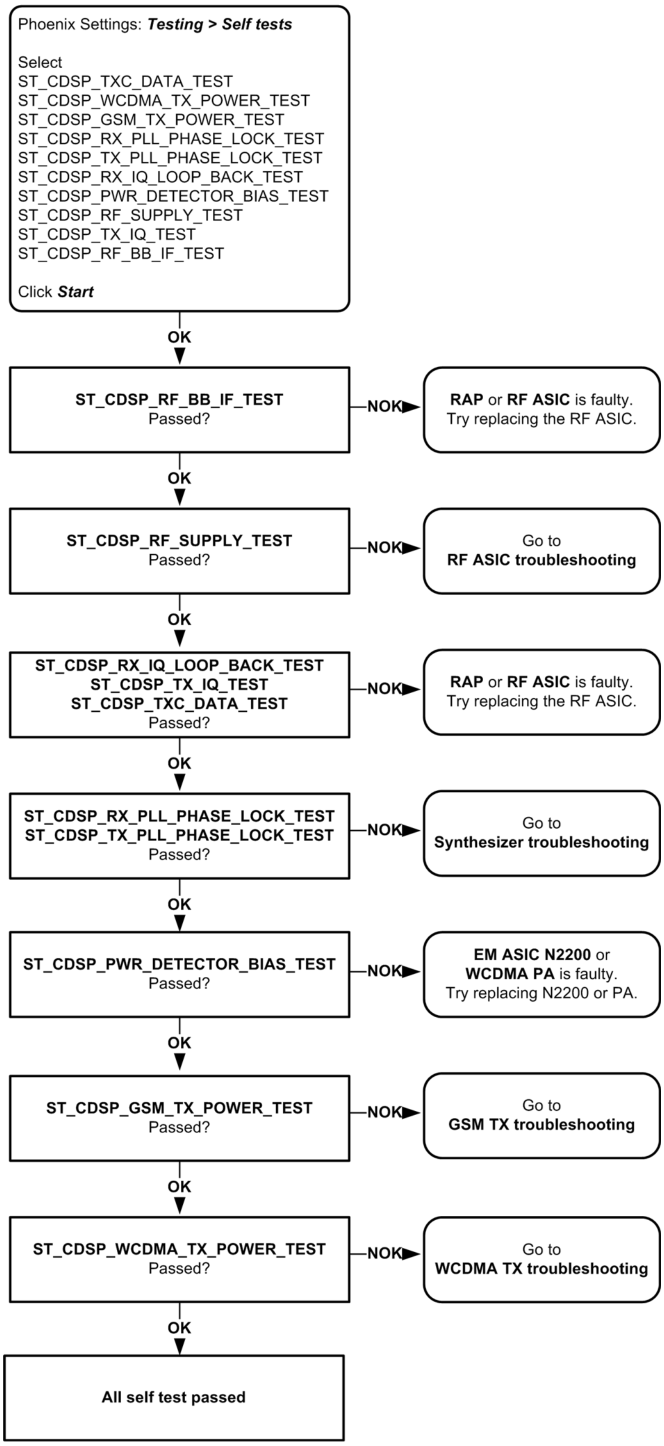
RF self tests in Phoenix

Context

Always start the troubleshooting procedure by running the Phoenix self tests. If a test fails, please follow the diagram below.

Troubleshooting flow


Phoenix Settings: *Testing > Self tests*
Select
ST_CDSP_TXC_DATA_TEST
ST_CDSP_WCDMA_TX_POWER_TEST
ST_CDSP_GSM_TX_POWER_TEST
ST_CDSP_RX_PLL_PHASE_LOCK_TEST
ST_CDSP_TX_PLL_PHASE_LOCK_TEST
ST_CDSP_RX_IQ_LOOP_BACK_TEST
ST_CDSP_PWR_DETECTOR_BIAS_TEST
ST_CDSP_RF_SUPPLY_TEST
ST_CDSP_TX_IQ_TEST
ST_CDSP_RF_BB_IF_TEST
Click *Start*
OK
ST_CDSP_RF_BB_IF_TEST Passed?
NOK
RAP or **RF ASIC** is faulty. Try replacing the RF ASIC.
OK
ST_CDSP_RF_SUPPLY_TEST Passed?
NOK
Go to **RF ASIC troubleshooting**
OK
ST_CDSP_RX_IQ_LOOP_BACK_TEST
ST_CDSP_TX_IQ_TEST
ST_CDSP_TXC_DATA_TEST Passed?
NOK
RAP or **RF ASIC** is faulty. Try replacing the RF ASIC.
OK
ST_CDSP_RX_PLL_PHASE_LOCK_TEST
ST_CDSP_TX_PLL_PHASE_LOCK_TEST Passed?
NOK
Go to **Synthesizer troubleshooting**
OK
ST_CDSP_PWR_DETECTOR_BIAS_TEST Passed?
NOK
EM ASIC N2200 or **WCDMA PA** is faulty. Try replacing N2200 or PA.
OK
ST_CDSP_GSM_TX_POWER_TEST Passed?
NOK
Go to **GSM TX troubleshooting**
OK
ST_CDSP_WCDMA_TX_POWER_TEST Passed?
NOK
Go to **WCDMA TX troubleshooting**
OK
All self test passed

General RF troubleshooting

Introduction to RF troubleshooting

Most RF semiconductors are static discharge sensitive

ESD protection must be applied during repair (ground straps and ESD soldering irons).

Pre-baking

These parts are moisture sensitive and must be pre-baked prior to soldering:

- RFIC N7505
- Front End Module (FEM) N7520

Discrete components

In addition to the key-components, there are a number of discrete components (resistors, inductors and capacitors) for which troubleshooting is done mainly by *visual inspection*.

Capacitors: check for short circuits.

Resistors: check value with an ohm meter.

Note: In-circuit measurements should be evaluated carefully

Measuring equipment

All measurements should be done using:

- An oscilloscope for low frequency and DC measurements. Recommended probe: 10:1, 10Mohm//8pF.
- A radio communication tester including RF generator and spectrum analyser, for example Rohde & Schwarz CMU200. (Alternatively a spectrum analyser and an RF generator can be used. Some tests in this guide are not possible to perform if this solution is chosen).

Note: A mobile phone WCDMA transmitter should never be tested with full TX power (only it possible to perform the measurements in a good RF-shielded room). Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.

Note: All measurements with an RF coupler should be performed in an RF-shielded environment because nearby base stations can disturb sensitive receiver measurements. If there is no possibility to use RF shielded environment, testing at frequencies of nearby base stations should be avoided.

Level of repair

The scope of this guideline is to enable repairs at key-component level. Some key-components are not accessible, i.e. not replaceable. Please refer to the list of *Non replaceable RF components*.

Note: If the RF shieldning can is removed (for measurement or repair), it must always be replaced with a new one.

RF key components

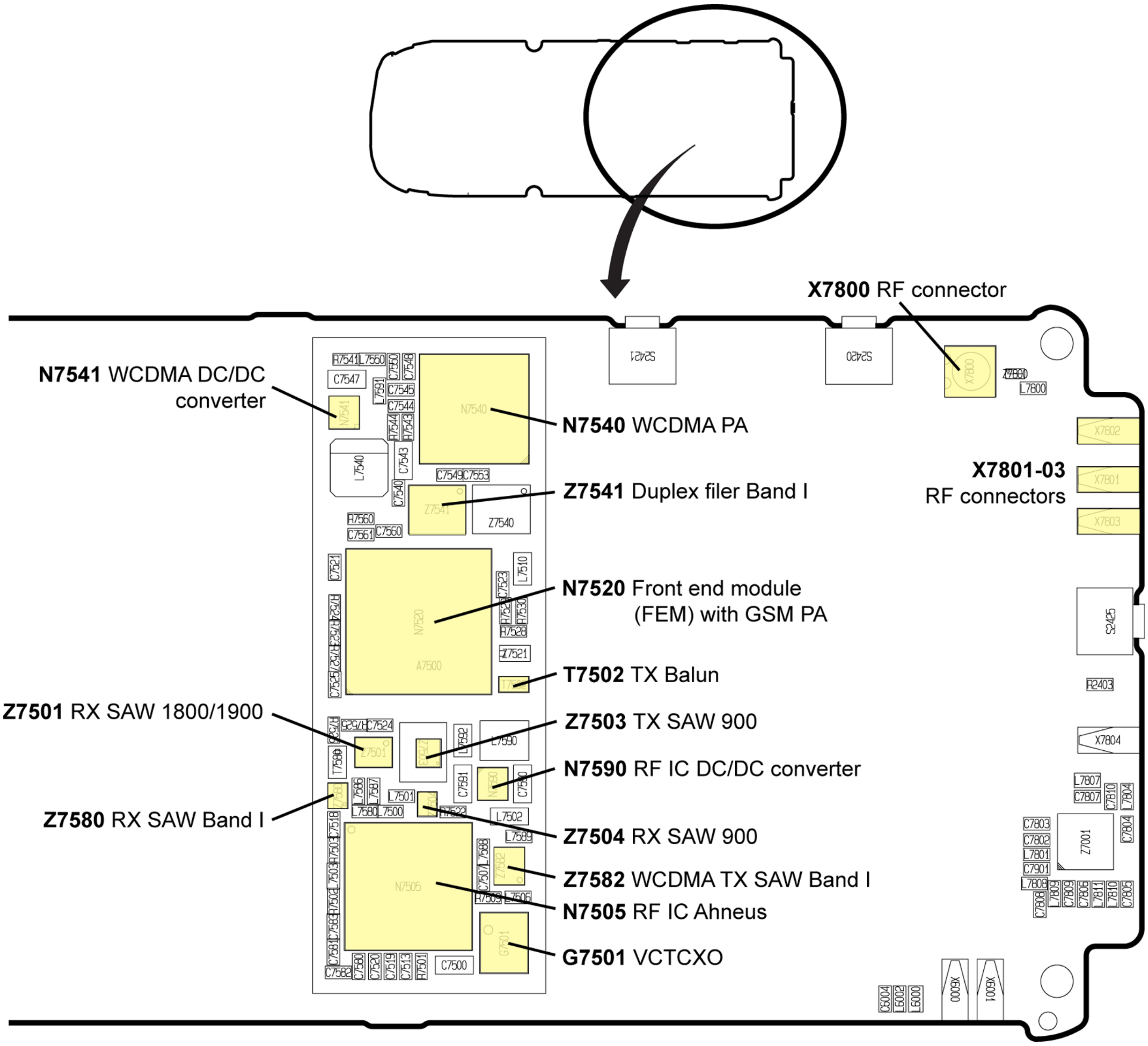

X7800 RF connector
N7541 WCDMA DC/DC converter
N7540 WCDMA PA
Z7541 Duplex filer Band I
X7801-03 RF connectors
N7520 Front end module (FEM) with GSM PA
T7502 TX Balun
Z7501 RX SAW 1800/1900
Z7503 TX SAW 900
N7590 RF IC DC/DC converter
Z7580 RX SAW Band I
Z7504 RX SAW 900
Z7582 WCDMA TX SAW Band I
N7505 RF IC Ahneus
G7501 VCTCXO

Figure 17 RF key components

Non-replaceable RF components

Because of their location on the PWB, the following RF components cannot be replaced without replacing the whole shield frame:

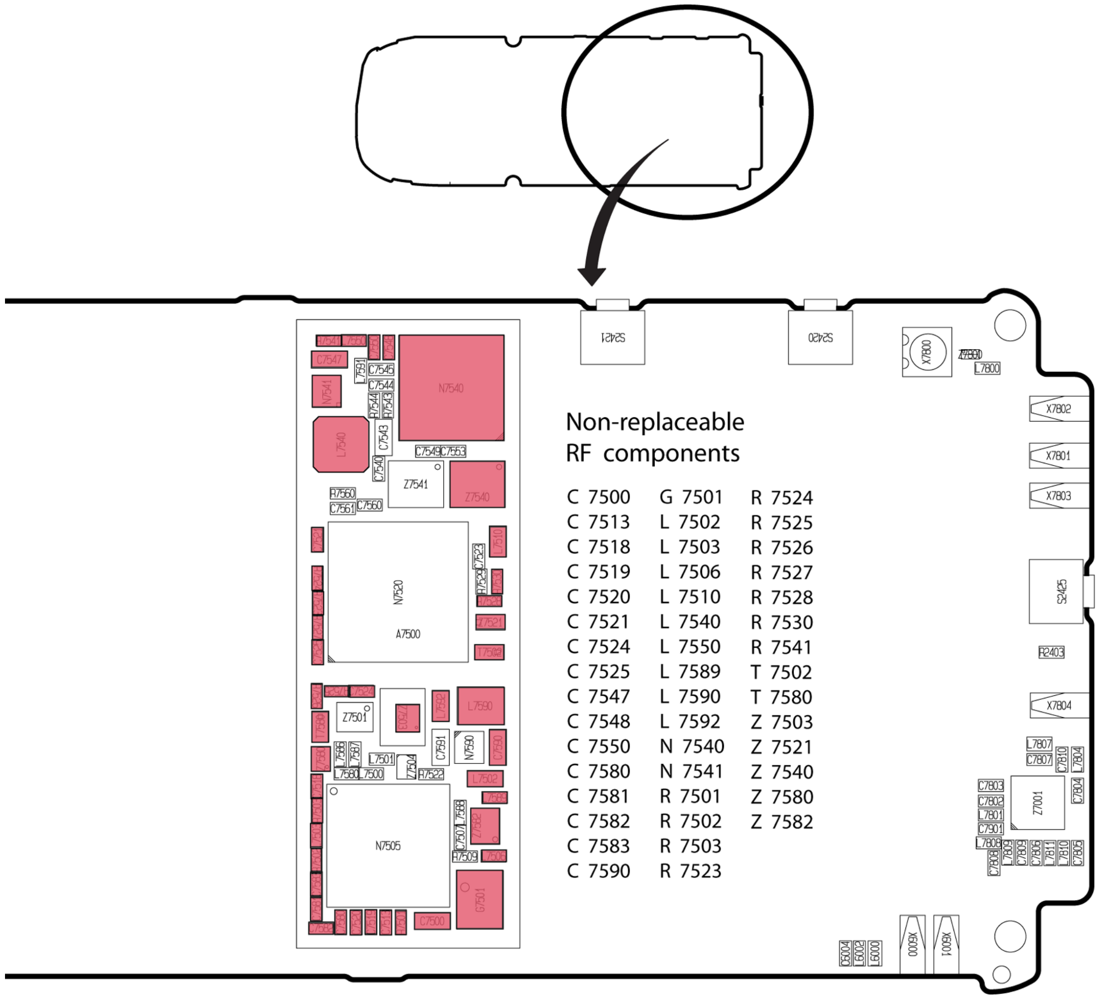

Non-replaceable
RF components
C 7500
C 7513
C 7518
C 7519
C 7520
C 7521
C 7524
C 7525
C 7547
C 7548
C 7550
C 7580
C 7581
C 7582
C 7583
C 7590
G 7501
L 7502
L 7503
L 7506
L 7510
L 7540
L 7550
L 7589
L 7590
L 7592
N 7540
N 7541
R 7501
R 7502
R 7503
R 7523
R 7524
R 7525
R 7526
R 7527
R 7528
R 7530
R 7541
T 7502
T 7580
Z 7503
Z 7521
Z 7540
Z 7580
Z 7582
N7540
N7520
A7500
N7505
Z7541
Z7540
Z7501
G7501
S2421
S2420
S2425
X7800
X7802
X7801
X7803
X7804
Z7001
X6000
X6001

Figure 18 Non-replaceable RF components

Auto tuning for BB5.0

This phone can be tuned automatically.

Autotune is designed to align the phone's RF part easier and faster. It performs calibrations, tunings and measurements of RX and TX. The results are displayed and logged in a result file, if initiated.

Hardware set up

Hardware requirements for auto tuning:

- PC (Windows 2000/XP) with GPIB card
- Power supply
- Product specific module jig
- Cables: XRF-1 (RF cable), USB cable, GPIB cable and DAU-9S
- Signal analyser (TX), signal generator (RX) and RF-splitter *or* one device including all.

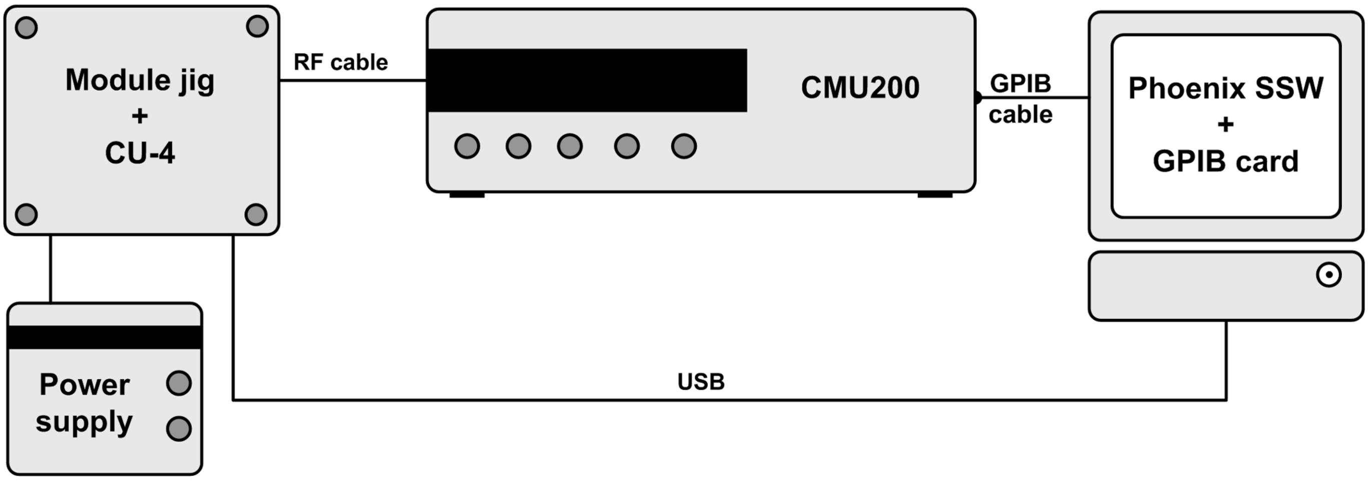


Figure 19 Auto tuning concept with CMU200

Note: Crossover Cable connection between computer and CU200 is recommended (refer to Service Devices chapter and Module Jig concept).

Phoenix preparations

Install the phone specific data package, for example *RM-396_dp_1.78_sw_sh3.26.exe*. This defines phone specific settings.

Auto tuning procedure

1 Make sure the phone (in the jig) is connected to the equipment. Else, some menus will not be shown in Phoenix.

2 To go to autotune, select *Tuning (Alt-U)* > *Auto-Tune (Alt-A)* from the menu.

3 Start autotuning, clicking the *Tune* button.

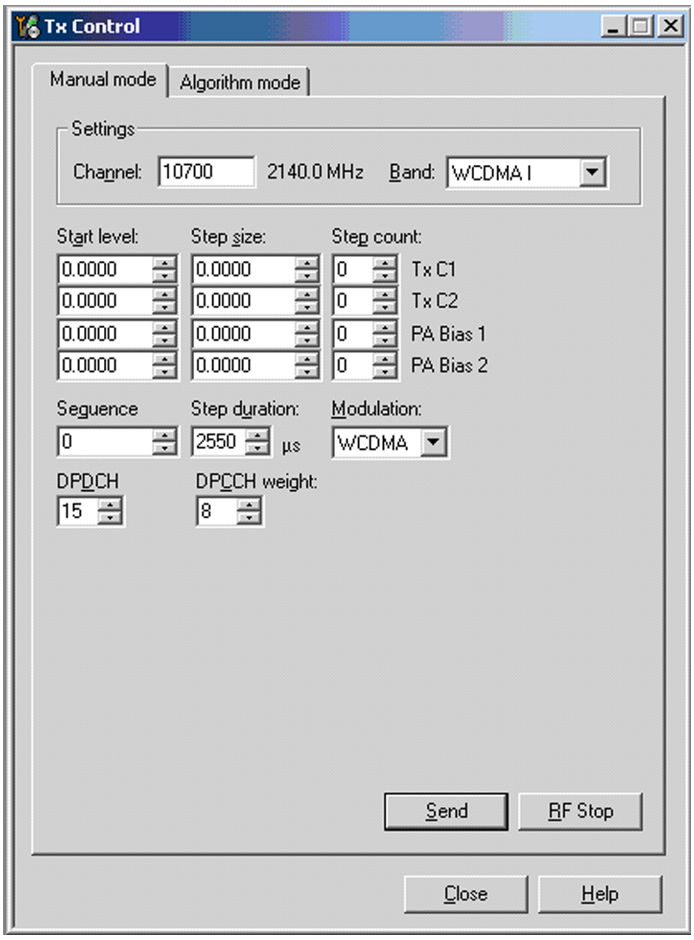
General voltage checking

Steps

1. Set up the main board in the module jig. The phone should be in local mode.
2. Check the following:

#	Signal name	Test point	Voltage (all bands)
1	VCTCXO supply	R7501	2.5 V
2	AHNEUS supply from DC/DC conv	C7590	3.1 V
3	FEM supply	C7523	3.9 V
4	WCDMA PA supply from DC/DC conv	C7543	0 V (1.3 V* when transmitting. Settings as in note below)
5	Vbat at WCDMA PA	C7547	3.9 V
6	Supply input to DC/DC conv	L7591	3.9 V

* With these settings, the result should be 1.3 V.


Tx Control
Manual mode
Algorithm mode
Send
RF Stop
Close
Help

Settings

Channel: 10700 2140.0 MHz Band: WCDMA I

Start level:	Step size:	Step count:	
0.0000	0.0000	0	Tx C1
0.0000	0.0000	0	Tx C2
0.0000	0.0000	0	PA Bias 1
0.0000	0.0000	0	PA Bias 2

Sequence: 0

Step duration: 2550 µs

Modulation: WCDMA

DPDCH: 15

DPCCH weight: 8

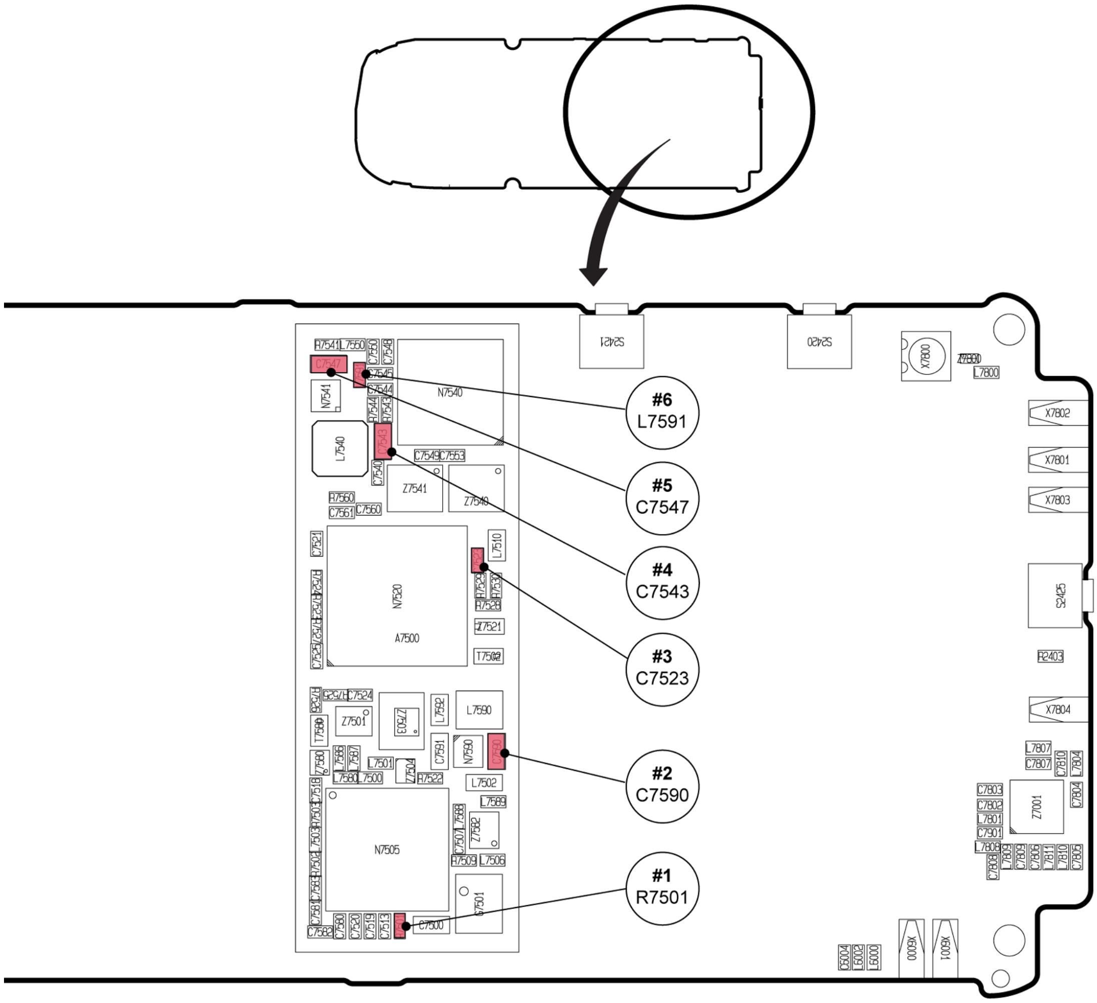

#6
L7591
#5
C7547
#4
C7543
#3
C7523
#2
C7590
#1
R7501
N7540
N7520
A7500
N7505
S2421
S2420
S2425
X7800
X7802
X7801
X7803
X7804
Z7001
X6000
X6001

Figure 20 General voltage checking test points (main board, top side)

Receiver troubleshooting

Introduction to receiver (RX) troubleshooting

RX can be tested by making a phone call or in local mode. For the local mode testing, use Phoenix service software.

The main RX troubleshooting measurement is RSSI reading. This test measures the signal strength of the received signal. For GSM RSSI measurements, see *GSM RX chain activation for manual measurements/GSM RSSI measurement*. For a similar test in WCDMA mode, see *WCDMA RSSI measurement*.

GSM RX chain activation for manual measurements/GSM RSSI measurement

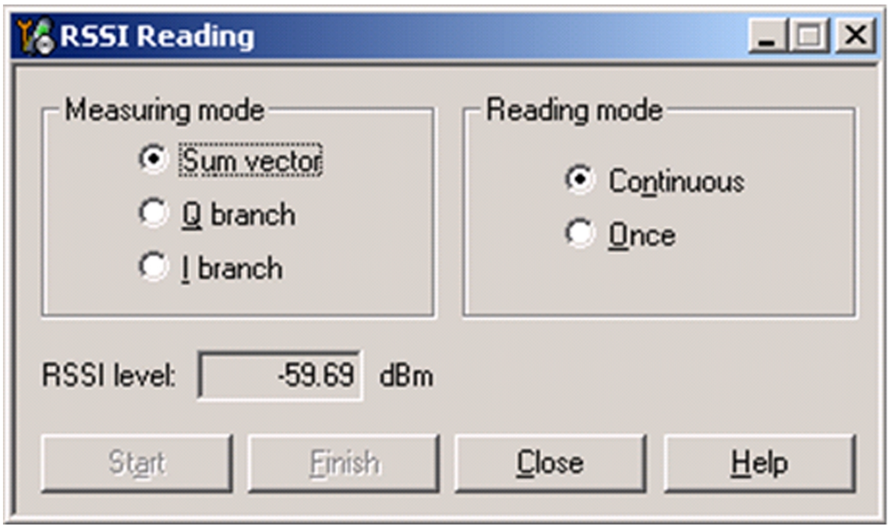
Prerequisites

Make the following settings in Phoenix service software:

Setting	GSM900	GSM1800	GSM1900
Phoenix Channel	37	700	661
Signal generator to antenna connector	942.46771MHz (67.71kHz offset) at -60dBm	1842.86771MHz (67.71kHz offset) at -60dBm	1960.046771MHz (67.71kHz offset) at -60dBm

Steps

1. Set the phone to local mode.
2. Activate RSSI reading in Phoenix (**Testing→GSM→RSSI reading**)



● Sum vector
○ Q branch
○ I branch

● Continuous
○ Once

RSSI level: -59.69 dBm

Results

The reading should reflect the level of the signal generator (-losses) +/- 5 dB.

When varying the level in the range -30 to -102 dBm the reading should then follow within +/-5 dB.

WCDMA RX chain activation for manual measurement/WCDMA RSSI measurement

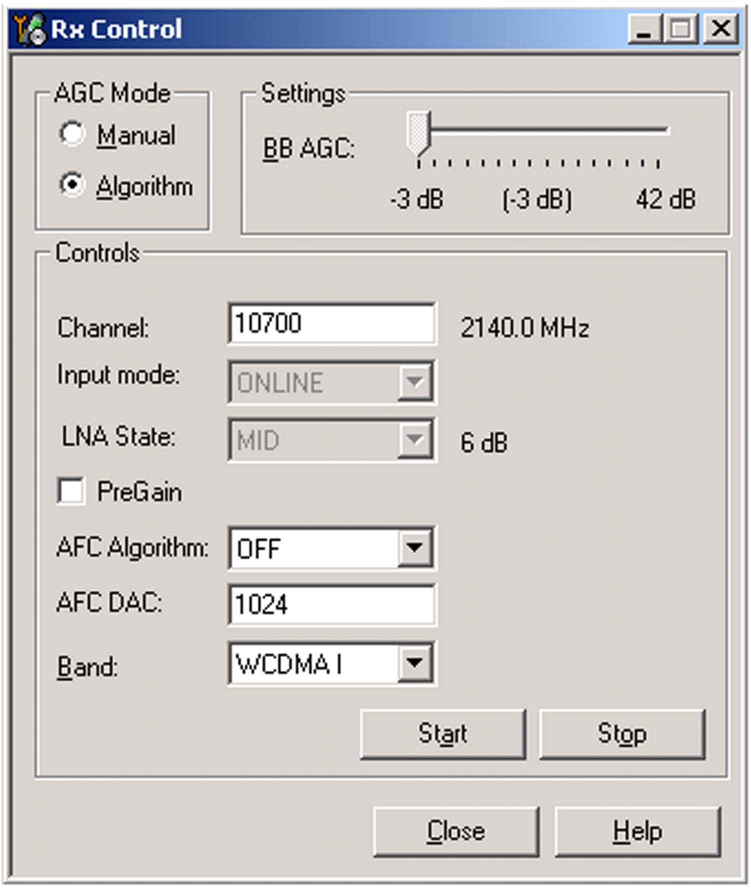
Prerequisites

Make the following settings in Phoenix service software and in the signal generator.

Setting	Band I
Phoenix channel	10700
Signal generator to antenna connector	2141.0 MHz

Steps

1. Via Phoenix Testing menu, choose **WCDMA/RX Control**.
2. In the RX control window, make the following settings:


Rx Control

AGC Mode
○ Manual
● Algorithm

Settings
BB AGC: -3 dB (-3 dB) 42 dB

Controls
Channel: 10700 2140.0 MHz
Input mode: ONLINE
LNA State: MID 6 dB
☐ PreGain
AFC Algorithm: OFF
AFC DAC: 1024
Band: WCDMA I

Figure 21 RX Control window with example settings

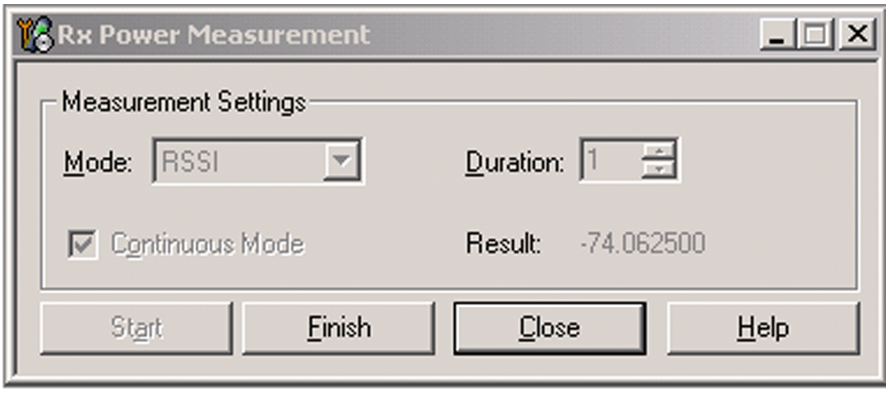
3. Click **Start** to activate the settings.

   If the settings are changed later on (for example, change of channel) you have to click **Stop** and **Start** again.

   Note: Clicking **Stop** also disables TX control if it was active.

4. From the Phoenix testing menu, select **WCDMA→RX Power measurement**

5. In the RX Power measurement window, select:
   - Mode: RSSI
   - Continuous mode


Rx Power Measurement

Measurement Settings
Mode: RSSI
Duration: 1
☑ Continuous Mode
Result: -74.062500

6. Click **Start** to perform the measurement.

Results

The reading should reflect the level of the signal generator (-losses) ± 5 dB.

Transmitter troubleshooting

General instructions for transmitter (TX) troubleshooting

Please note the following before performing transmitter tests:

- TX troubleshooting requires TX operation.
- Do not transmit on frequencies that are in use!
- The transmitter can be controlled in local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is “RF Controls”; in WCDMA transmitter testing the best tool is “TX Control”.
- Remember that re-tuning is not a fix! Phones are tuned correctly in production

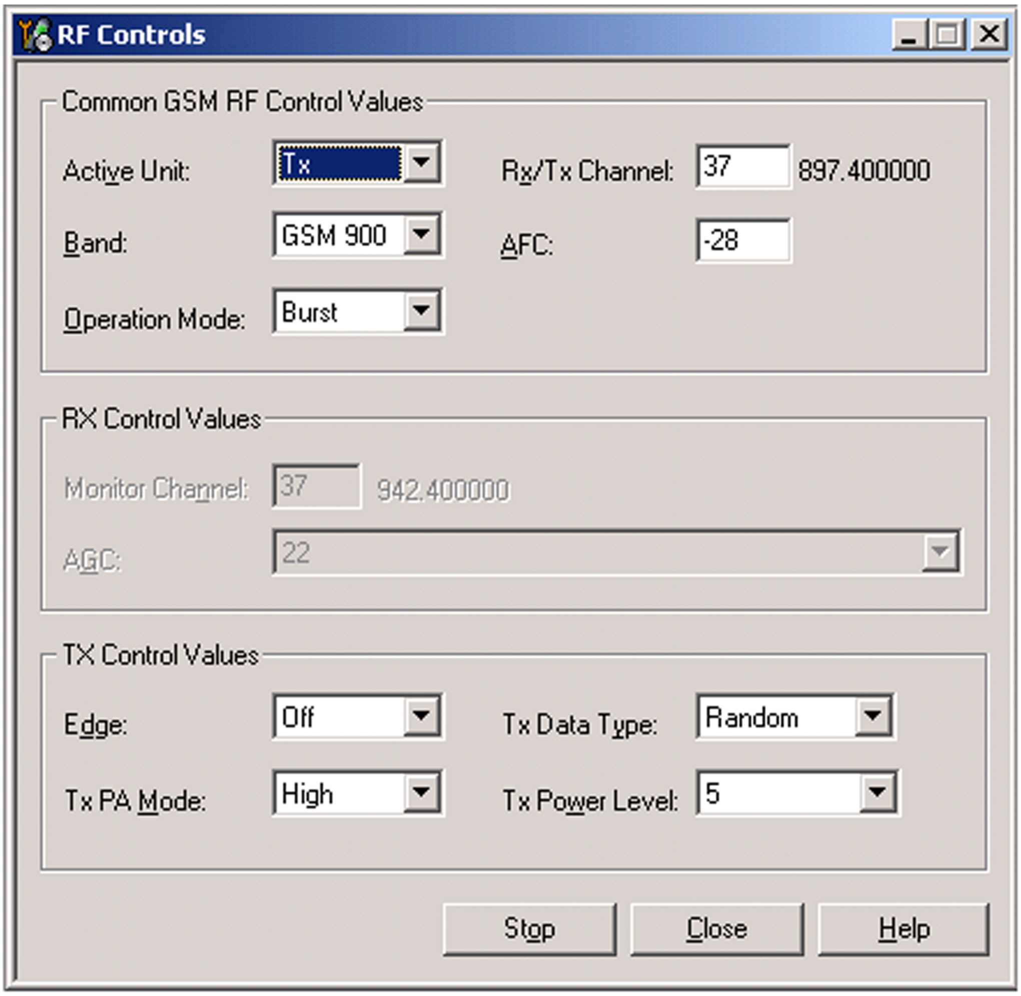
Note: Never activate the GSM or WCDMA transmitter without a proper antenna load. Always connect a 50 Ω load to the RF connector (antenna, RF-measurement equipment or at least a 2 W dummy load); otherwise the GSM or WCDMA Power amplifier (PA) may be damaged.

GSM transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. Activate RF controls in Phoenix (**Testing**→**GSM**→**Rf Controls**).

   Make settings as shown in the picture:



RF Controls
Common GSM RF Control Values
RX Control Values
TX Control Values
Stop
Close
Help

Active Unit: Tx

Band: GSM 900

Operation Mode: Burst

Rx/Tx Channel: 37 897.400000

AFC: -28

Monitor Channel: 37 942.400000

AGC: 22

Edge: Off

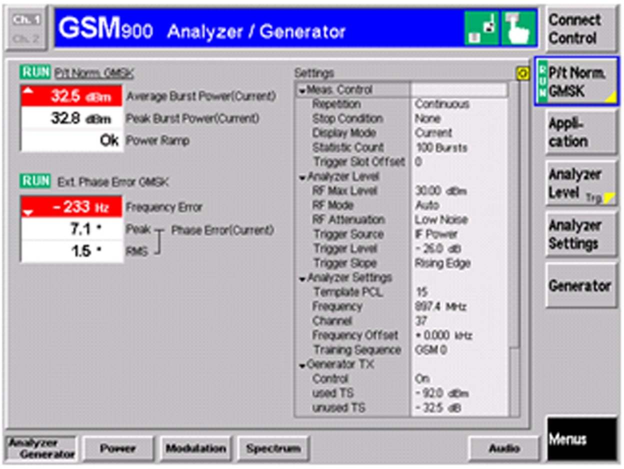
Tx PA Mode: High

Tx Data Type: Random

Tx Power Level: 5

3. Check the basic TX parameters (i.e. power, phase error, modulation and switching spectrum), using a communication analyser (for example CMU200).

Analyser settings


Ch. 1
Ch. 2
GSM900 Analyzer / Generator
Connect Control
P/t Norm. GMSK
Appli- cation
Analyzer Level Trg
Analyzer Settings
Generator
Menus
Analyzer Generator
Power
Modulation
Spectrum
Audio

RUN P/t Norm. GMSK

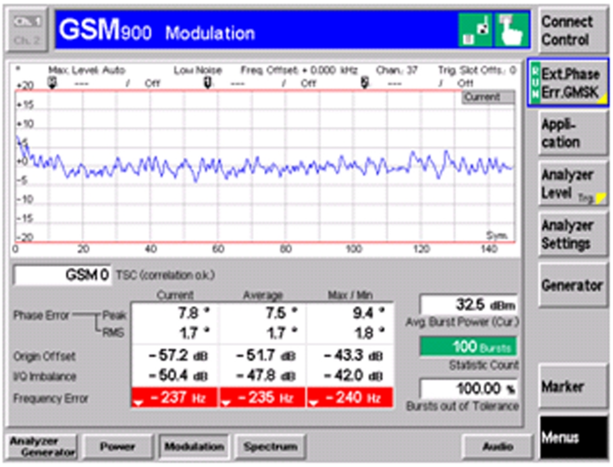
32.5 dBm Average Burst Power(Current)
32.8 dBm Peak Burst Power(Current)
Ok Power Ramp

RUN Ext. Phase Error GMSK

-233 Hz Frequency Error
7.1 ° Peak Phase Error(Current)
1.5 ° RMS

Settings
- Meas. Control
  - Repetition: Continuous
  - Stop Condition: None
  - Display Mode: Current
  - Statistic Count: 100 Bursts
  - Trigger Slot Offset: 0
- Analyzer Level
  - RF Max Level: 30.00 dBm
  - RF Mode: Auto
  - RF Attenuation: Low Noise
  - Trigger Source: IF Power
  - Trigger Level: -26.0 dB
  - Trigger Slope: Rising Edge
- Analyzer Settings
  - Template PCL: 15
  - Frequency: 897.4 MHz
  - Channel: 37
  - Frequency Offset: +0.000 kHz
  - Training Sequence: GSM 0
- Generator TX
  - Control: On
  - used TS: -92.0 dBm
  - unused TS: -32.5 dB

Phase error

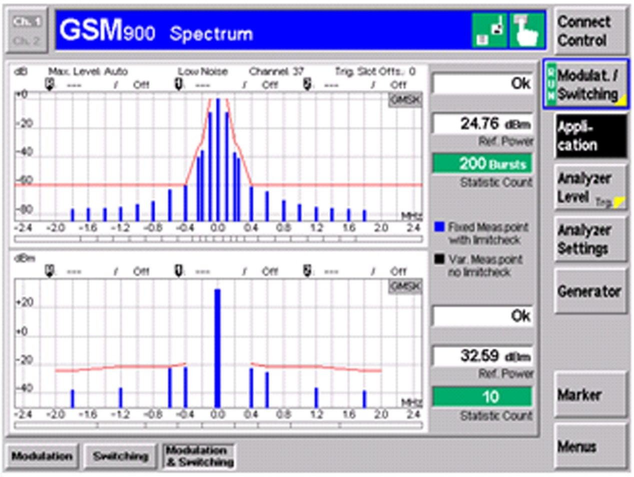

Ch. 1
Ch. 2
GSM900 Modulation
Connect Control
Ext.Phase Err.GMSK
Appli- cation
Analyzer Level Trg
Analyzer Settings
Generator
Marker
Menus
Max. Level: Auto
Low Noise
Freq. Offset: +0.000 kHz
Chan.: 37
Trig. Slot Offs.: 0
Off
Current
+20
+15
+10
+5
+0
-5
-10
-15
-20
Sym.
0
20
40
60
80
100
120
140
Analyzer Generator
Power
Modulation
Spectrum
Audio

GSM 0 TSC (correlation o.k.)

		Current	Average	Max / Min
Phase Error	Peak	7.8 °	7.5 °	9.4 °
	RMS	1.7 °	1.7 °	1.8 °
Origin Offset		-57.2 dB	-51.7 dB	-43.3 dB
I/Q Imbalance		-50.4 dB	-47.8 dB	-42.0 dB
Frequency Error		-237 Hz	-235 Hz	-240 Hz

32.5 dBm Avg. Burst Power (Cur.)
100 Bursts Statistic Count
100.00 % Bursts out of Tolerance

Modulation/Switching spectrum

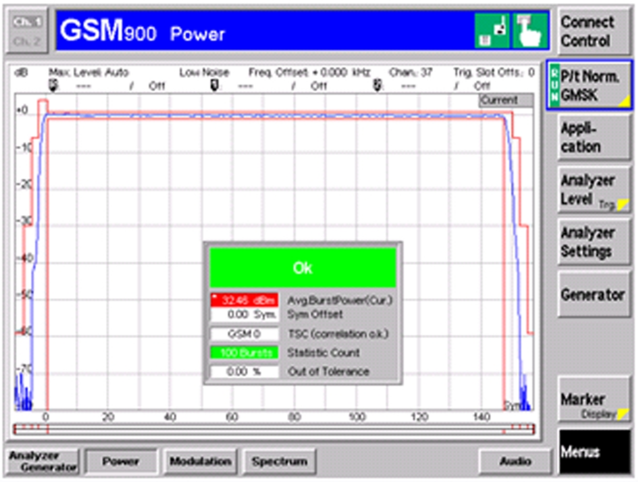

Ch. 1
Ch. 2
GSM900 Spectrum
Connect Control
Modulat. / Switching
Appli- cation
Analyzer Level Trg
Analyzer Settings
Generator
Marker
Menus
dB
Max. Level: Auto
Low Noise
Channel: 37
Trig. Slot Offs.: 0
Off
GMSK
+0
-20
-40
-60
-80
MHz
-2.4
-2.0
-1.6
-1.2
-0.8
-0.4
0.0
0.4
0.8
1.2
1.6
2.0
2.4
dBm
+20
+0
-20
-40
Modulation
Switching
Modulation & Switching

Ok
24.76 dBm Ref. Power
200 Bursts Statistic Count

■ Fixed Meas.point with limitcheck
■ Var. Meas.point no limitcheck

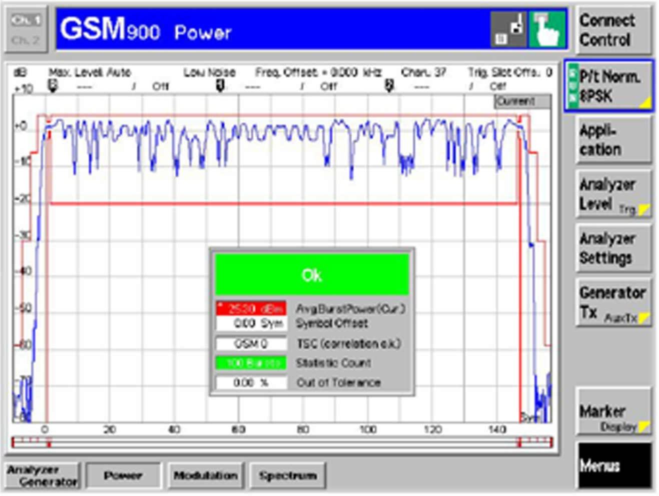
Ok
32.59 dBm Ref. Power
10 Statistic Count

Power/Burst


Ch. 1
Ch. 2
GSM900 Power
Connect Control
P/t Norm. GMSK
Appli- cation
Analyzer Level Trg
Analyzer Settings
Generator
Marker Display
Menus
dB
Max. Level: Auto
Low Noise
Freq. Offset: +0.000 kHz
Chan.: 37
Trig. Slot Offs.: 0
Off
Current
+0
-10
-20
-30
-40
-50
-60
-70
Sym.
0
20
40
60
80
100
120
140
Analyzer Generator
Power
Modulation
Spectrum
Audio

Ok
32.46 dBm Avg.BurstPower(Cur.)
0.00 Sym. Sym.Offset
GSM 0 TSC (correlation o.k.)
100 Bursts Statistic Count
0.00 % Out of Tolerance

Edge


Ch. 1
Ch. 2
GSM900 Power
Connect Control
P/t Norm. 8PSK
Appli- cation
Analyzer Level Trg
Analyzer Settings
Generator Tx AuxTx
Marker Display
Menus
dB
Max. Level: Auto
Low Noise
Freq. Offset: +0.000 kHz
Chan.: 37
Trig. Slot Offs.: 0
Off
Current
+10
+0
-10
-20
-30
-40
-50
-60
-70
Sym.
0
20
40
60
80
100
120
140
Analyzer Generator
Power
Modulation
Spectrum

Ok
25.30 dBm Avg.BurstPower(Cur.)
0.00 Sym. Symbol Offset
GSM 0 TSC (correlation o.k.)
100 Bursts Statistic Count
0.00 % Out of Tolerance

Figure 22 Typical readings

4. Change power level (RF controls) and make sure the power reading follows accordingly.

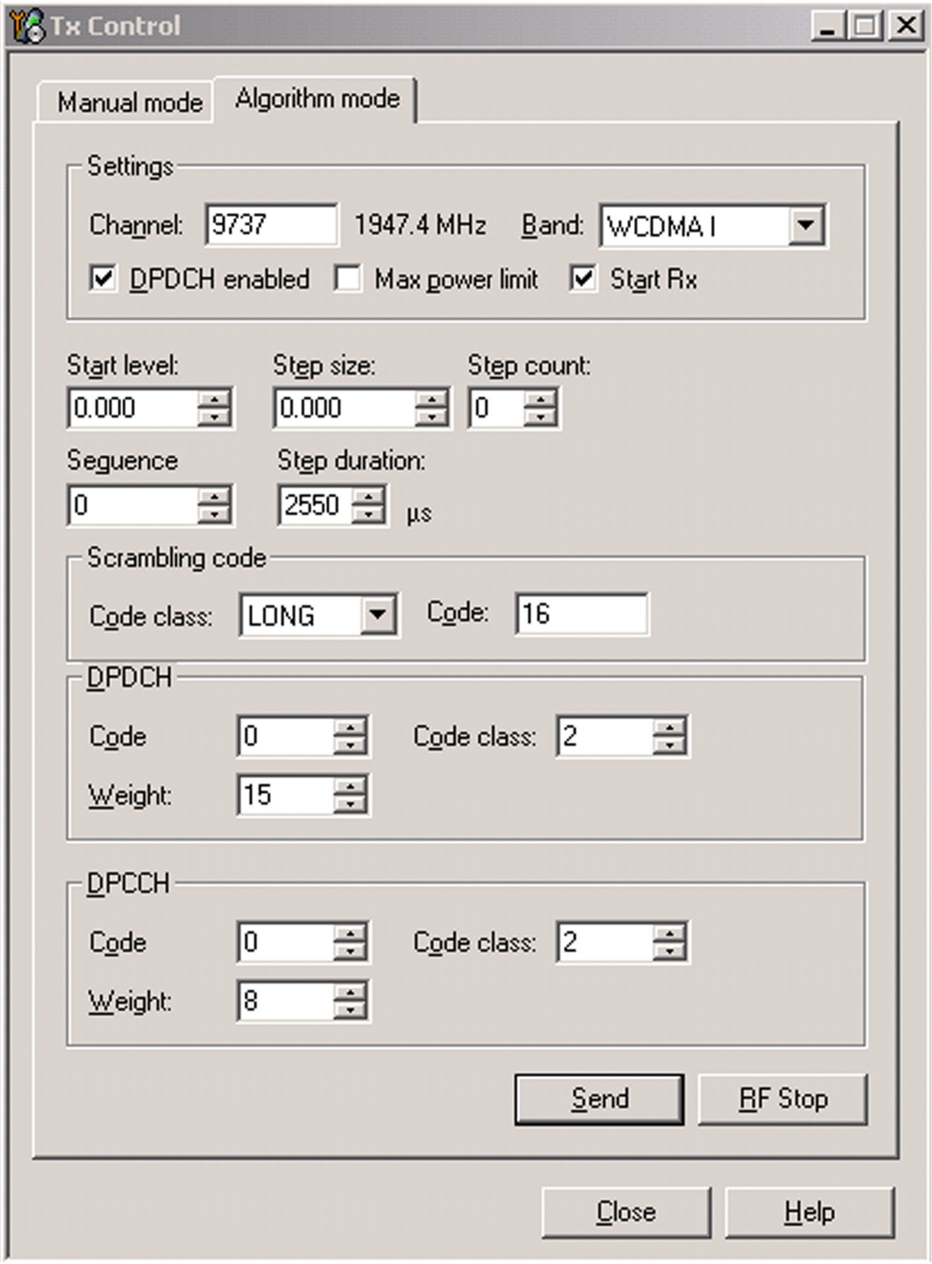
Next actions

If you want to troubleshoot the other bands, change band with RF controls and set the communication analyser accordingly.

WCDMA transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. In Phoenix, select **Testing→WCDMA→TX control** .
3. In the TX control window, make settings like in the picture:



Channel: 9737 1947.4 MHz Band: WCDMA I
☑ DPDCH enabled ☐ Max power limit ☑ Start Rx
Start level: 0.000
Step size: 0.000
Step count: 0
Sequence 0
Step duration: 2550 µs
Scrambling code
Code class: LONG
Code: 16
DPDCH
Code 0
Code class: 2
Weight: 15
DPCCH
Code 0
Code class: 2
Weight: 8

4. Click **Send** to enable the settings and activate TX.

   If settings are changed (eg. new channel), you have to click **RF Stop** and **Send** again.

Bluetooth and FM radio troubleshooting

Bluetooth troubleshooting

Troubleshooting flow

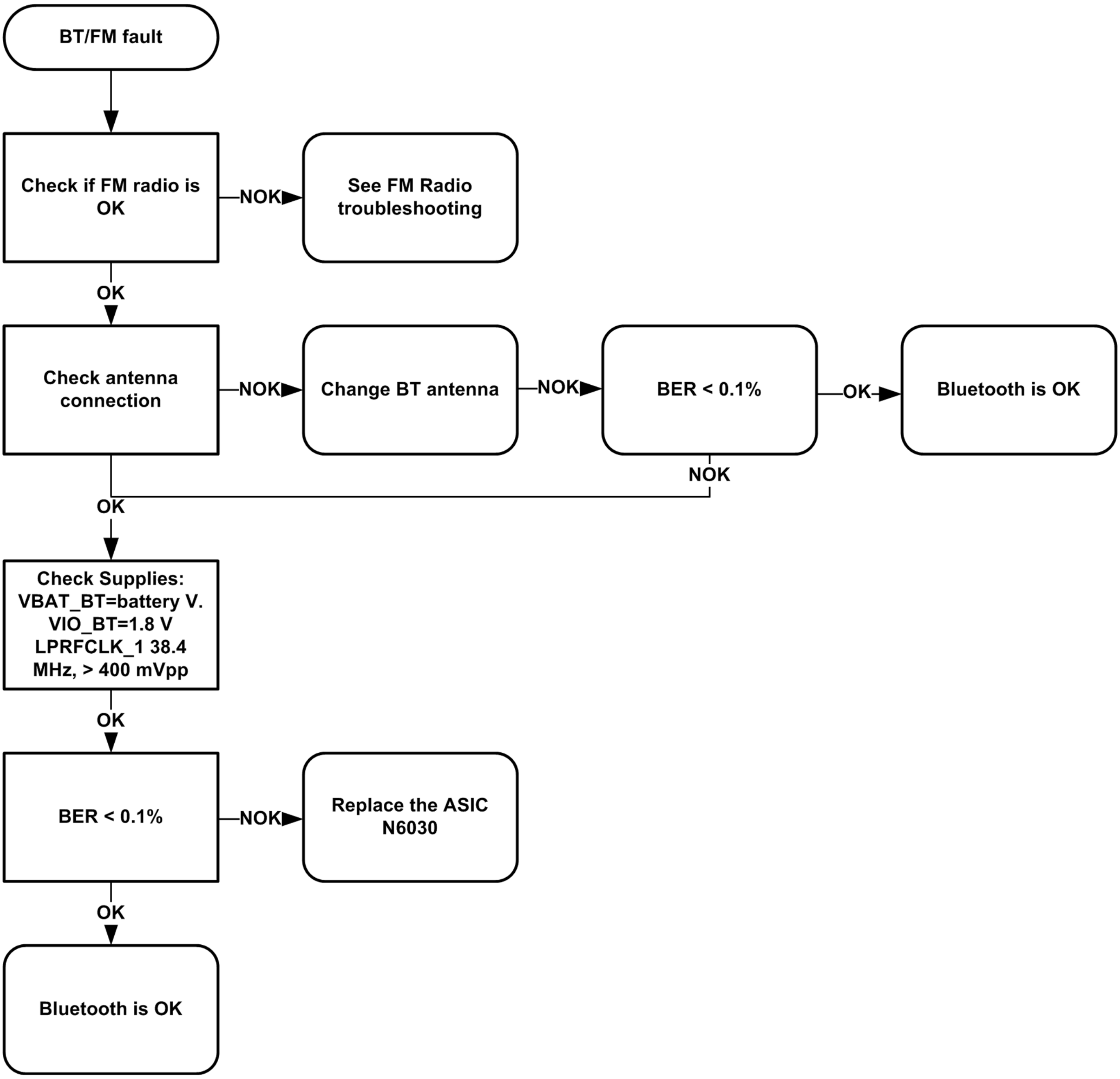

BT/FM fault
Check if FM radio is OK
NOK
See FM Radio troubleshooting
OK
Check antenna connection
NOK
Change BT antenna
NOK
BER < 0.1%
OK
Bluetooth is OK
NOK
OK
Check Supplies: VBAT_BT=battery V. VIO_BT=1.8 V LPRFCLK_1 38.4 MHz, > 400 mVpp
OK
BER < 0.1%
NOK
Replace the ASIC N6030
OK
Bluetooth is OK

Figure 23 Troubleshooting diagram: Bluetooth

FM radio troubleshooting

Troubleshooting flow

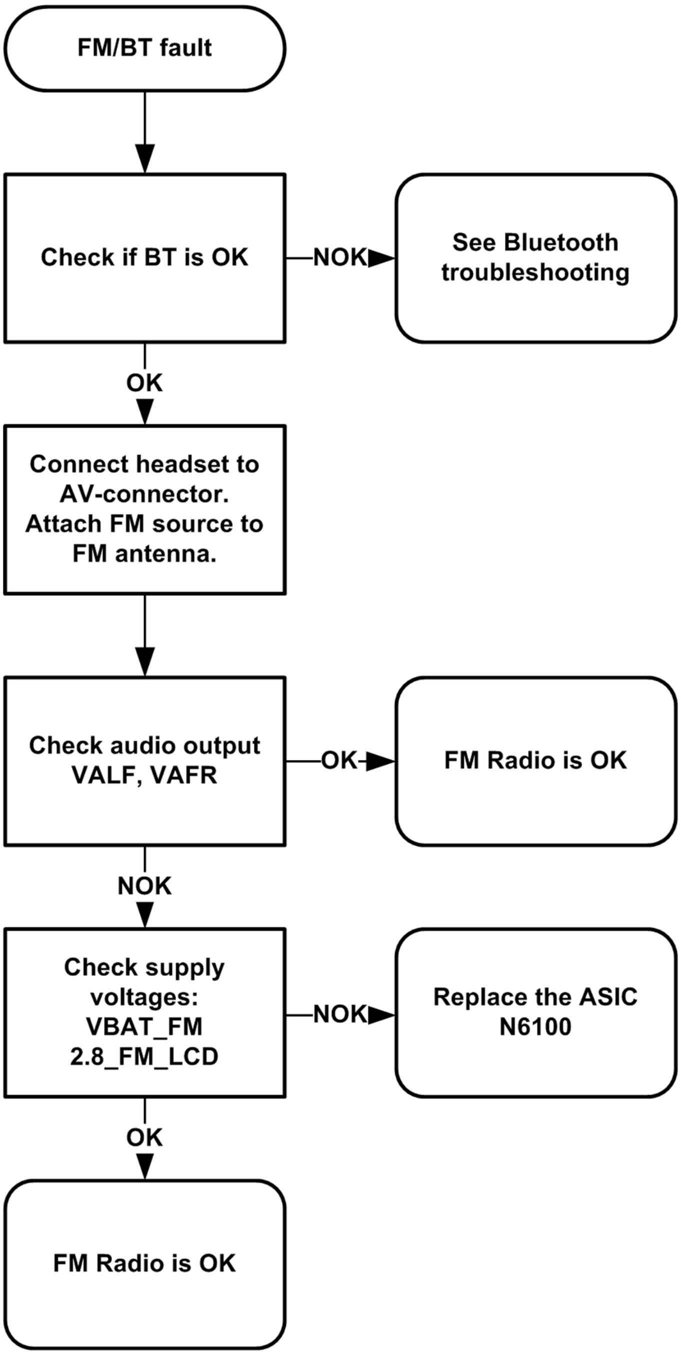

FM/BT fault
Check if BT is OK
NOK
See Bluetooth troubleshooting
OK
Connect headset to AV-connector. Attach FM source to FM antenna.
Check audio output VALF, VAFR
OK
FM Radio is OK
NOK
Check supply voltages: VBAT_FM 2.8_FM_LCD
NOK
Replace the ASIC N6100
OK
FM Radio is OK

Figure 24 Troubleshooting diagram: FM radio

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5 — System Module Description

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Table of Contents

Introduction 5–5
    Phone description 5–5
Energy management 5–8
    Battery and charging 5–8
    Normal and extreme voltages 5–10
    Power key and system power-up 5–10
    Modes of operation 5–10
USB, SIM, µSD 5–11
    Micro USB interface 5–11
    SIM interface 5–11
    µSD card interface 5–12
User interface 5–12
    Display module 5–12
    Backlight and illumination 5–12
Camera concept 5–12
Audio concept 5–13
NFC (Near field communication) 5–14
RF description 5–16
    Receiver (RX) 5–16
    Transmitter (TX) 5–17
    Bluetooth 5–17
    FM radio 5–18

List of Tables

Table 10 Nominal voltages 5–10

List of Figures

Figure 25 Main board 5–6
Figure 26 Battery pin order 5–9
Figure 27 Battery connector 5–9
Figure 28 Wide (left) and small (right) charger plugs 5–9
Figure 29 SIM interface 5–11
Figure 30 µSD card interface 5–12
Figure 31 Audio block diagram 5–13
Figure 32 Near field communication with phone as reader or tag 5–15
Figure 33 NFC block diagram 5–16
Figure 34 Bluetooth interface 5–18
Figure 35 FM interface 5–18

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Introduction

Phone description

RAP is the main digital baseband ASIC in the phone. It contains functionality for both WCDMA and GSM EDGE. The hardware accelerator is used as a camera accelerator.

N2200 (AVILMA) is mainly the audio ASIC in the phone and N2300 (BETTY) is basically the energy management controller for the phone.

Key components

Function	Description	Item ref
Main board	2pc-20	
NFC board	2pd-20	
Energy management ASIC	AVILMA BETTY	N2200 N2300
RF ASIC	Ahneus	N7505
Processor	RAP3GS v2.0	D2800
Hardware (camera) accelerator	Julie	N1000
PA GSM	Front end module (FEM), quad band	N7520
PA WCDMA	Triple band PA	N7540
Oscillators	VCTCXO	G7501
Memory	512 Mbit NOR + 256 Mbit DRAM Combo (Stacked with RAP)	D2801
Back-up battery	RTC back-up battery 311	G2200
Bluetooth	BC4-ROM1	D6030
Battery	BL-4U 1000 mAh	
Battery connector	Tabby blade interface	X3400
µSD connector	For µSD card	X3200
µUSB connector	For data	X2002
LED driver		N2301

Key component placement

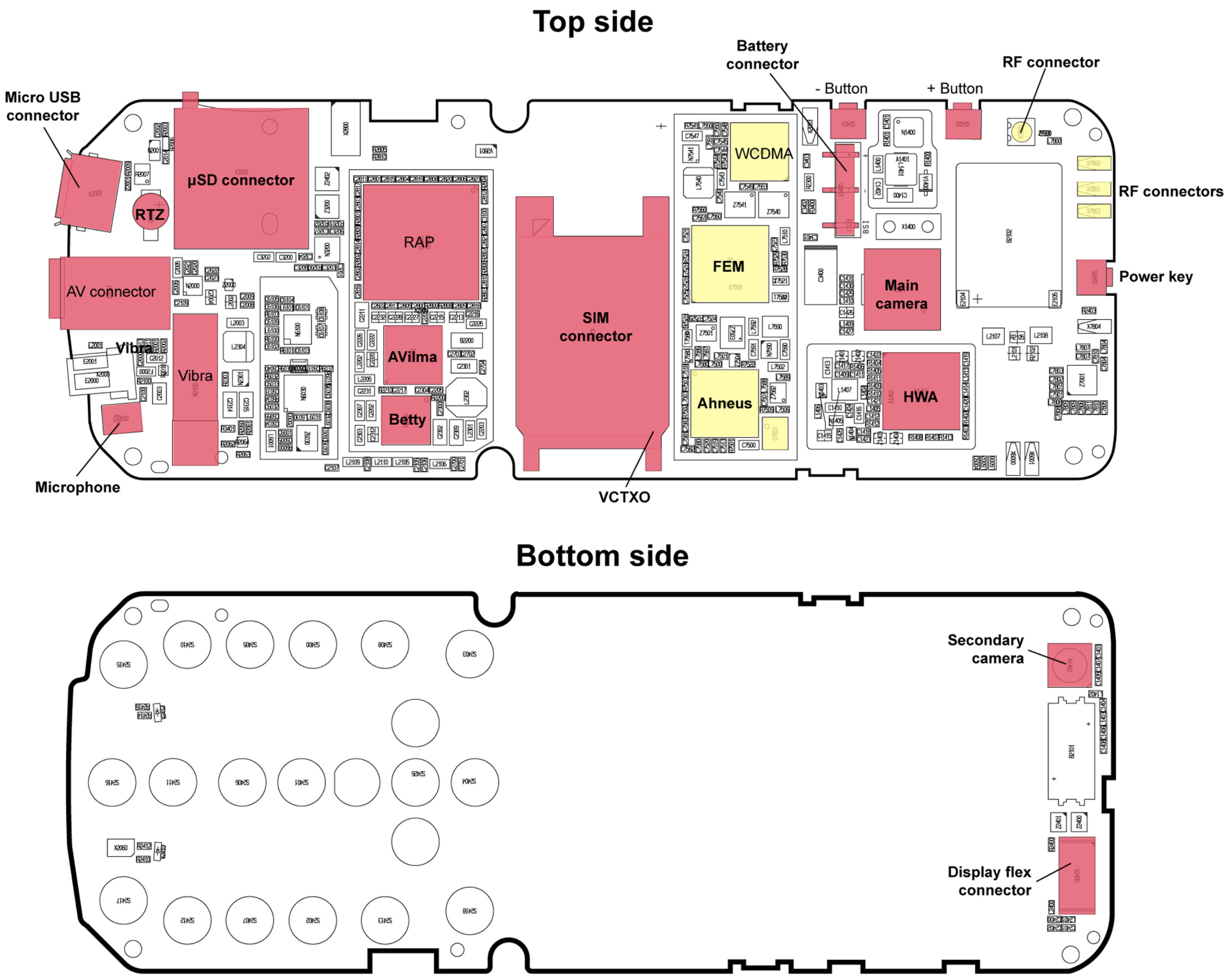
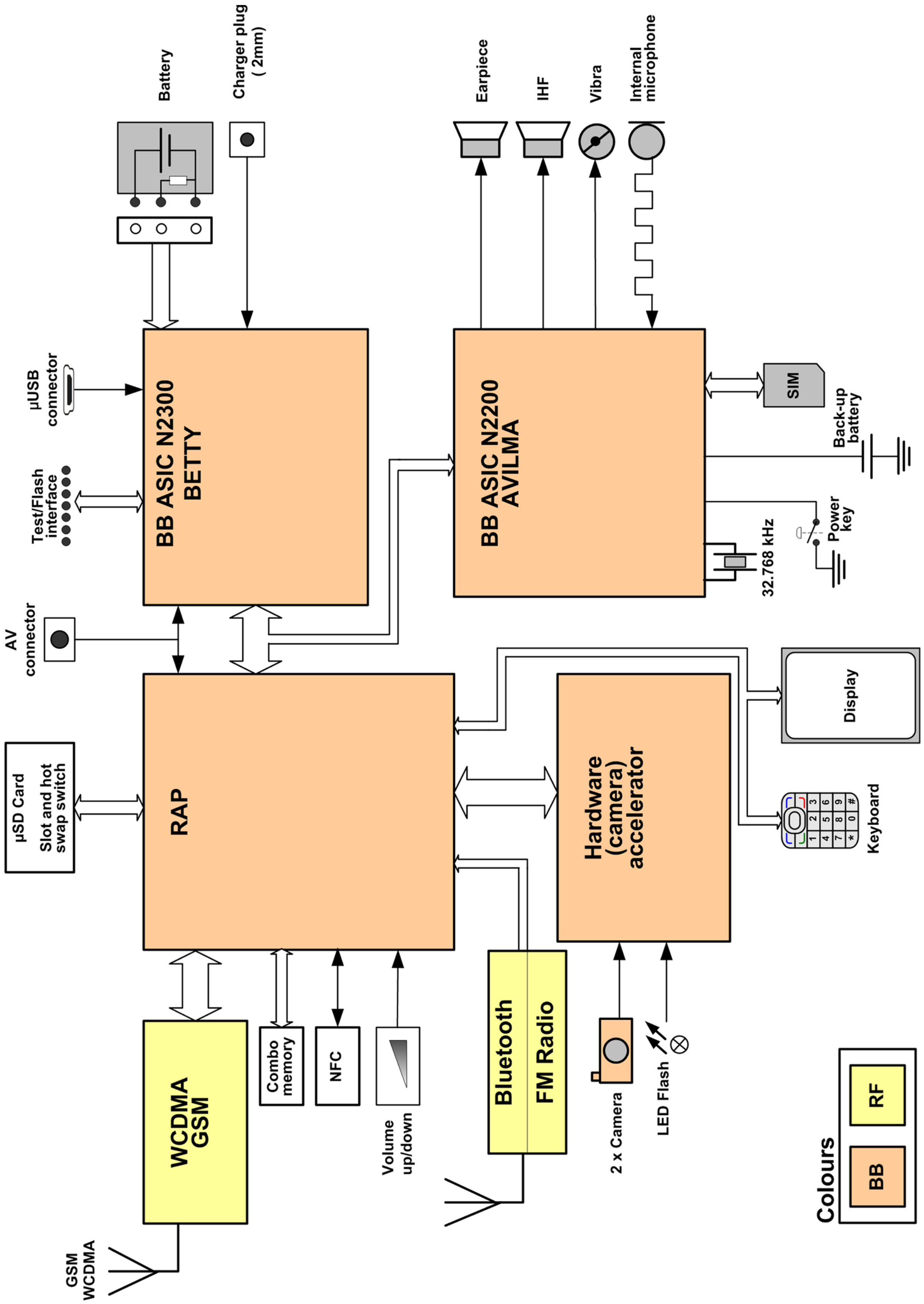
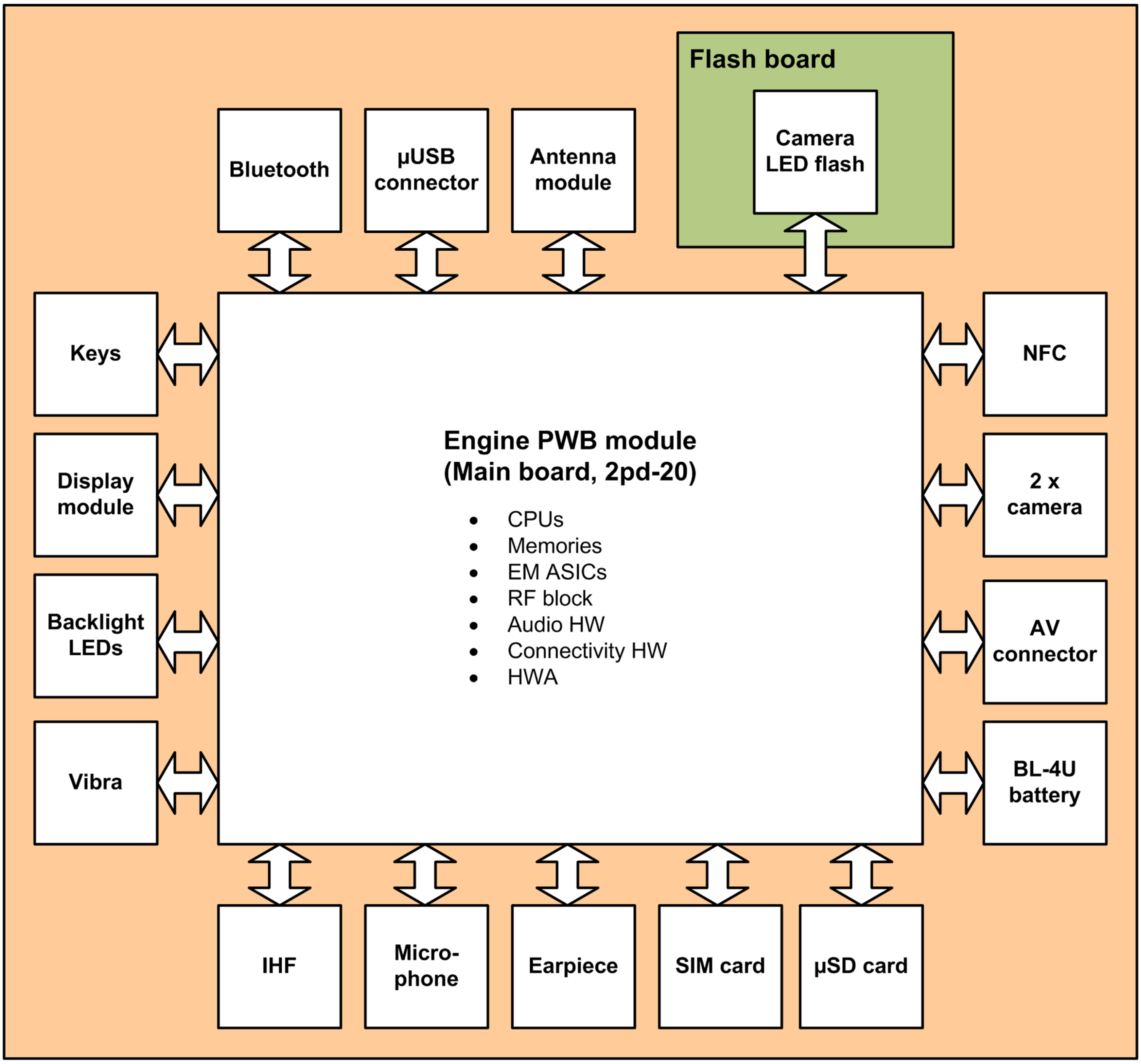

Top side
Battery connector
Micro USB connector
- Button
+ Button
RF connector
RF connectors
Power key
µSD connector
RTZ
RAP
AV connector
Vibra
Vibra
AVilma
Betty
SIM connector
WCDMA
FEM
Main camera
Ahneus
HWA
Microphone
VCTXO
Bottom side
Secondary camera
Display flex connector

Figure 25 Main board

System module block diagram


Battery
Charger plug (2mm)
Earpiece
IHF
Vibra
Internal microphone
µUSB connector
Test/Flash interface
BB ASIC N2300 BETTY
BB ASIC N2200 AVILMA
SIM
Back-up battery
Power key
32.768 kHz
AV connector
µSD Card Slot and hot swap switch
RAP
Hardware (camera) accelerator
Display
Keyboard
WCDMA GSM
Combo memory
NFC
Volume up/down
Bluetooth
FM Radio
2 x Camera
LED Flash
GSM WCDMA
Colours
BB
RF

Board and module connections


Flash board
Camera LED flash
Bluetooth
µUSB connector
Antenna module
Keys
Display module
Backlight LEDs
Vibra
Engine PWB module (Main board, 2pd-20)
CPUs
Memories
EM ASICs
RF block
Audio HW
Connectivity HW
HWA
NFC
2 x camera
AV connector
BL-4U battery
IHF
Micro-phone
Earpiece
SIM card
µSD card

Energy management

Battery and charging

BL-4U battery

The phone is powered by a 3-pole BL-4U 1000 mAh battery. The three poles are named VBAT, BSI and GND where the BSI line is used to recognize the battery capacity. This is done by means of an internal battery pull down resistor.

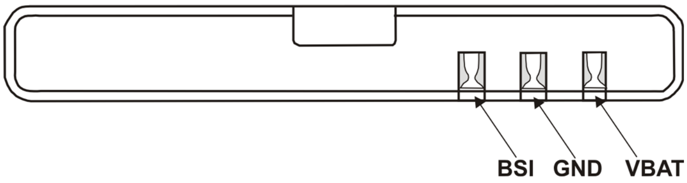


Figure 26 Battery pin order

The battery temperature can be measured from the main board.

Battery connector

The battery connector is a blade connector. It has three blades;

- BSI (Battery size indicator)
- GND (Ground)
- VBAT (Battery voltage)

The BSI line is used to recognize the battery capacity by a battery internal pull down resistor.

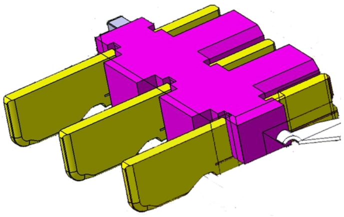


Figure 27 Battery connector

Charging

This phone is charged through the smaller Nokia standard interface (2.0 mm plug). The wider standard charger (3.5 mm) can be used together the CA-44 charger adapter.

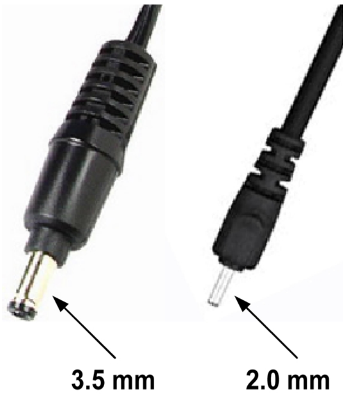


Figure 28 Wide (left) and small (right) charger plugs

Charging is controlled by energy management, and external components are needed to protect the baseband module against EMC, reverse polarity and transient frequency deviation.

Charging a dead battery

Charging of a dead battery has to be carried out via one of the two approved NOKIA chargers (AC-6 and DC-6). Charging via a PC is not allowed since this procedure is not including a current regulator (the battery can be charged with a too high current level).

Normal and extreme voltages

Energy management is mainly carried out in the two Application Specific Integrated Circuits (ASICs) N2300 BETTY and N2200 AVILMA. These two circuits contains a number of regulators. In addition there are some external regulators too.

In the table below normal and extreme voltages are shown when a BL-4U battery is used.

Table 10 Nominal voltages

Voltage	Voltage [V]	Condition
General Conditions		
Nominal voltage	4.0	
Lower extreme voltage	3.4	
Higher extreme voltage (fast charging)	4.4	
HW Shutdown Voltages		
Vmstr+	2.2 ± 0.1	Off to on
Vmstr-	2.2 ± 0.1	On to off
SW Shutdown Voltages		
Sw shutdown	3.1	In call
Sw shutdown	3.2	In idle
Min Operating Voltage		
Vcoff+	2.9 ± 0.1	Off to on
Vcoff-	2.6 ± 0.1	On to off

Power key and system power-up

When the battery is placed in the phone the power key circuits are energized. When the power key is pressed, the system boots up (if an adequate battery voltage is present).

Power down can be initiated by pressing the power key again (the system is powered down with the aid of SW). The power key is connected to EM ASIC N2200 (AVILMA) via PWRONX signal.

Modes of operation

Mode	Description
NO_SUPPLY	(dead) mode means that the main battery is not present or its voltage is too low (below N2200 AVILMA master reset threshold) and that the back-up battery voltage is too low.
BACK_UP	The main battery is not present or its voltage is too low but back-up battery voltage is adequate and the 32 kHz oscillator is running (RTC is on).
PWR_OFF	In this mode (warm), the main battery is present and its voltage is over N2300 BETTY master reset threshold. All regulators are disabled, PurX is on low state, the RTC is on and the oscillator is on. PWR_OFF (cold) mode is almost the same as PWR_OFF (warm), but the RTC and the oscillator are off.
RESET	RESET mode is a synonym for start-up sequence. RESET mode uses 32 kHz clock to count the REST mode delay (typically 16ms).

Mode	Description
SLEEP	SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system's activity is low.
FLASHING	FLASHING mode is for SW downloading.

USB, SIM, µSD

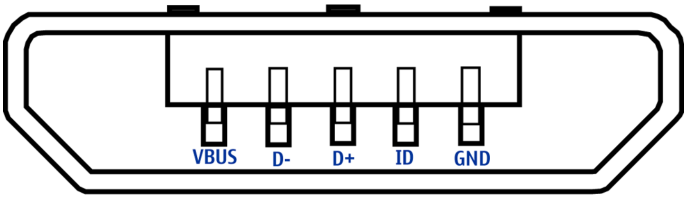
Micro USB interface

The micro USB (Universal Serial Bus) provides a wired connectivity between a PC and peripheral devices. It is a differential serial bus.

USB 2.0 is supported with full speed (12 Mbps).

Hot swap is supported, which means that USB devices may be plugged in/out at any time.

This phone is provided with a specific connector for µUSB.


VBUS
D-
D+
ID
GND

SIM interface

The device has one SIM (Subscriber Identification Module) interface. It is only accessible if battery is removed. The SIM interface consists of an internal interface between RAP and EM ASIC (N2200), and of an external interface between N2200 and SIM contacts.

The SIM IF is shown in the following figure:

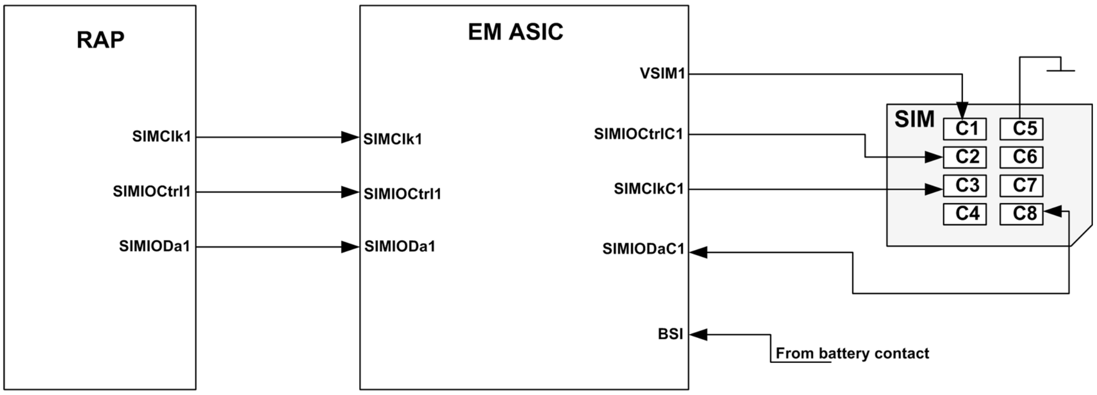

RAP
SIMClk1
SIMIOCtrl1
SIMIODa1
EM ASIC
SIMClk1
SIMIOCtrl1
SIMIODa1
VSIM1
SIMIOCtrlC1
SIMClkC1
SIMIODaC1
BSI
SIM
C1
C5
C2
C6
C3
C7
C4
C8
From battery contact

Figure 29 SIM interface

The EM ASIC handles the detection of the SIM card. The detection method is based in the BSI line. Because of the location of the SIM card, removing the battery causes a quick power down of the SIM interface.

The SIM interface supports both 1.8 V and 3.0 V SIM cards. The SIM interface voltage is first 1.8 V when the SIM card is inserted, and if the card does not response to the ATR, a 3 V interface voltage is used.

µSD card interface

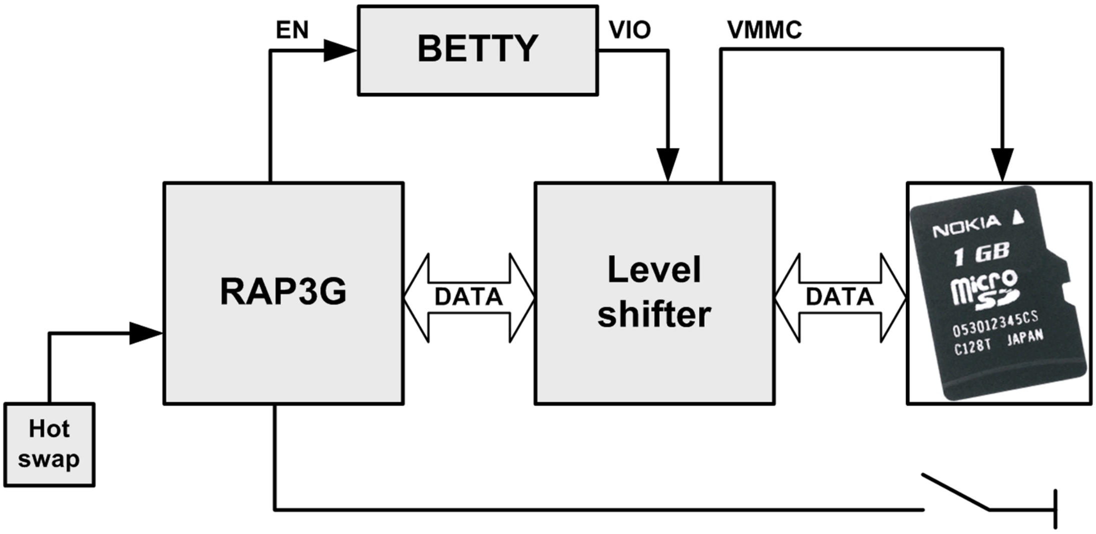

EN
BETTY
VIO
VMMC
RAP3G
DATA
Level shifter
DATA
NOKIA
1 GB
micro SD
053012345CS
C128T JAPAN
Hot swap

Figure 30 µSD card interface

The µSD card is connected to the engine by an external level shifter. Supplied voltages:

- VMMC: 2.85 V (from level shifter)
- VIO: 1.8 V (from AVILMA)

The card removal is detected by a push detect switch.

Hot swap is supported, which means that the card may be plugged in/out at any time, without removing the battery.

User interface

Display module

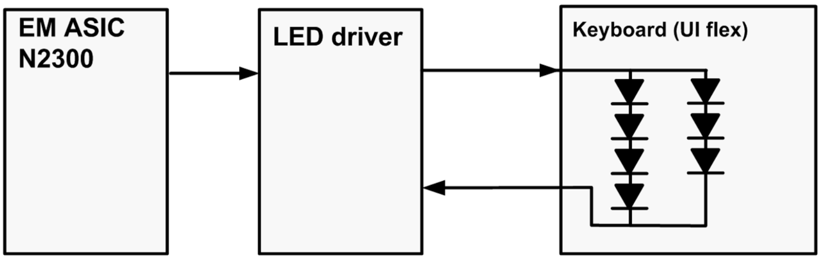
The interconnection between the LCD module and the engine is implemented with a 24-pin board-to-board connector.

The LCD module does not require any tuning in service.

Backlight and illumination

The display has no separate backlight, it is included in the display module.

The keypad, placed on the main board, is top lit by 7 LEDs.


EM ASIC
N2300
LED driver
Keyboard (UI flex)

Camera concept

This phone has two cameras:

- A main 2.0 megapixel camera with 8x zoom and a LED flash.

- A secondary VGA camera used for video calls.

Both cameras are supported by a hardware accelerator (HWA), which also handles the main camera flash function (LED flash diode).

Audio concept

The functional core of the audio hardware is built around EM ASIC N2200 and RAP.

N2200 provides an interface for the trancducers. Integrated hands free (IHF) stereo speakers are driven by D-class audio amplifiers.

There are three audio transducers:

- 1digital microphone
- 1 earpiece
- 1 IHF (internal handsfree) speaker

N2200 also provides an output for the vibra motor.

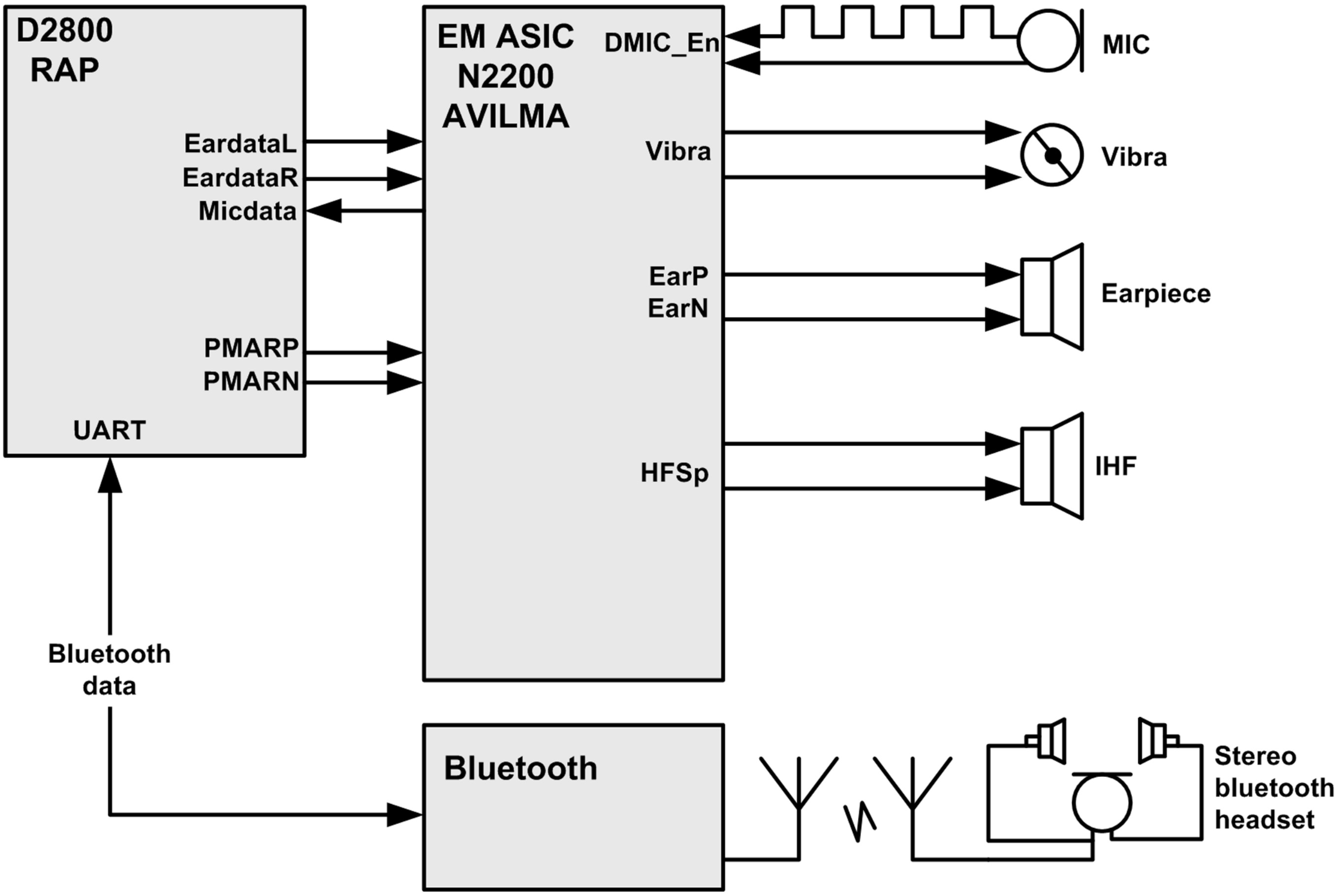

D2800
RAP
EardataL
EardataR
Micdata
PMARP
PMARN
UART
Bluetooth
data
EM ASIC
N2200
AVILMA
DMIC_En
Vibra
EarP
EarN
HFSp
MIC
Vibra
Earpiece
IHF
Bluetooth
Stereo
bluetooth
headset

Figure 31 Audio block diagram

Internal audio

The internal audio components are used in these modes:

	Hand portable (HP) mode	Internal hands free (IHF) mode
Microphone	X	X
Earpiece	X	

	Hand portable (HP) mode	Internal hands free (IHF) mode
Speaker		X

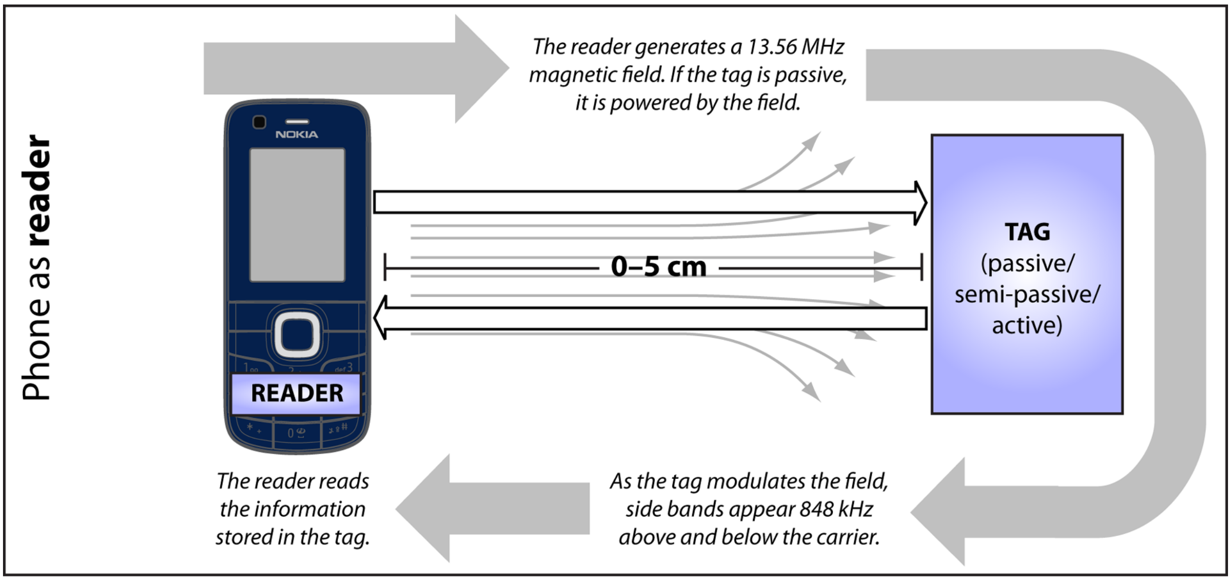
NFC (Near field communication)

Near Field Communication (NFC) is a standards-based, short-range wireless connectivity technology that enables simple and safe two-way interactions among electronic devices. NFC technology allows consumers to perform contactless transactions, access digital content and connect devices with the simplicity of a single touch.

Near Field Communication (NFC) technology provides global interoperability of contactless identification and interconnection technologies. NFC operates in the 13.56 MHz frequency range, over a typical distance of a few centimeters. The underlying layers of NFC technology are based on ISO, ECMA, and ETSI standards. NFC technology is supported by the world's leading communication device manufacturers, semiconductor producers, network operators, IT and services companies, and financial services organizations. NFC is compatible with hundreds of millions of contactless cards and readers already deployed worldwide.

NFC in general

Data is transferred between a reader and a tag by a 13.56 MHz magnetic field. The tag includes a memory, a processor and in some cases a transmitter. If the tag is passive, it is powered by the magnetic fied generated by the reader. The reader’s task is to read the data in the tag (reading range 0-5 cm), and perform an action based on the received data.


Phone as **reader**
The reader generates a 13.56 MHz magnetic field. If the tag is passive, it is powered by the field.
READER
0–5 cm
TAG (passive/ semi-passive/ active)
The reader reads the information stored in the tag.
As the tag modulates the field, side bands appear 848 kHz above and below the carrier.

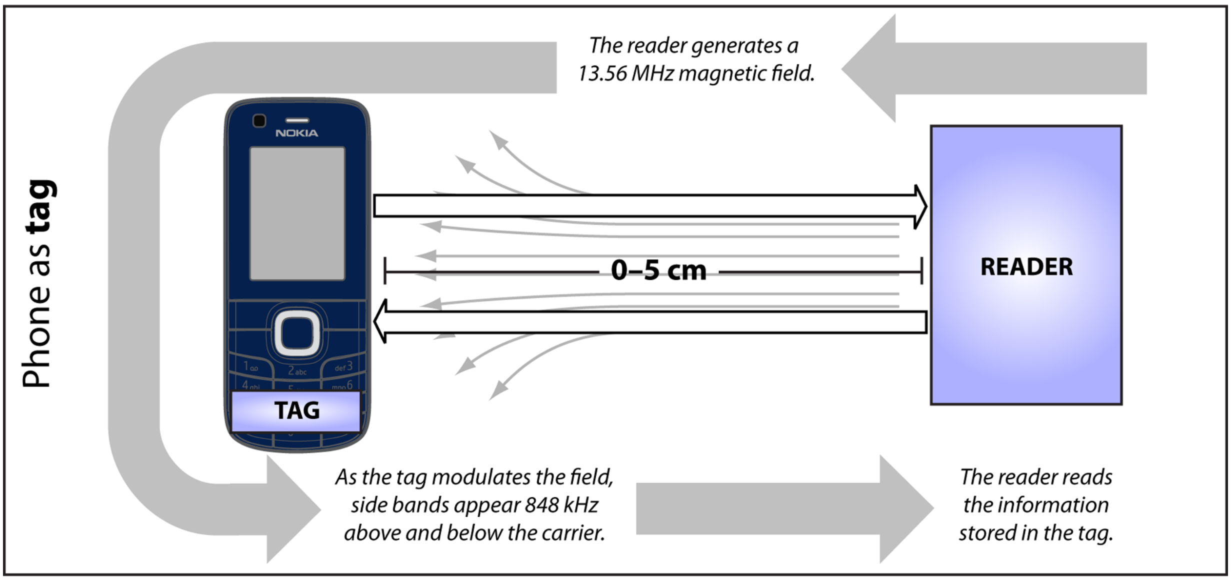

Phone as **tag**
The reader generates a 13.56 MHz magnetic field.
TAG
0–5 cm
READER
As the tag modulates the field, side bands appear 848 kHz above and below the carrier.
The reader reads the information stored in the tag.

Figure 32 Near field communication with phone as reader or tag

NFC in this device

The phone can act as either a reader or a tag (passive). The feature works in these operational modes:

- Standby
- Polling
- Power off

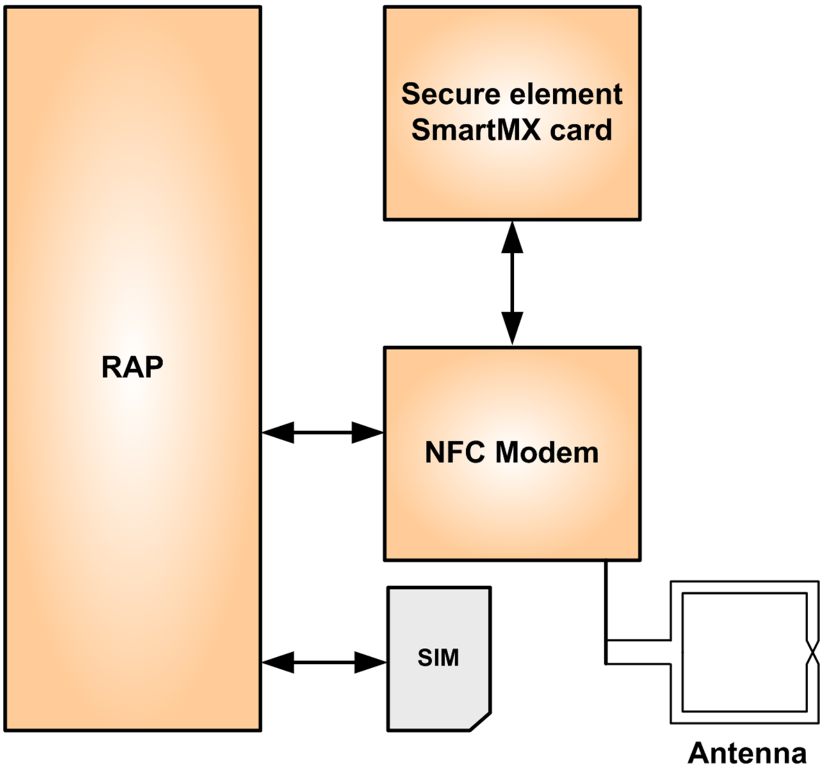


Figure 33 NFC block diagram

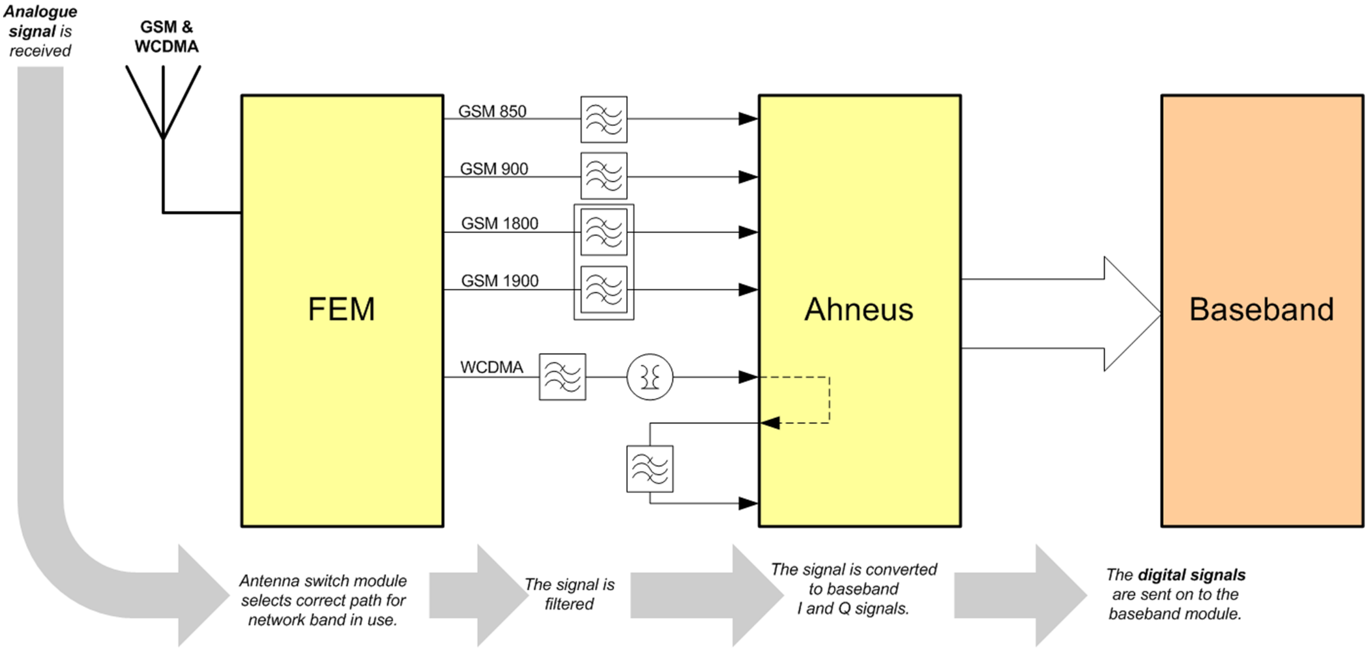
RF description

Receiver (RX)

An analogue signal is received by the phone's antenna. The signal is converted to a digital signal and is then transferred further to the baseband (eg. to the earpiece).

The receiver functions are implemented in the RF ASIC.

Signals with different frequencies take different paths, therefore being handled by different components. The principle of GSM and WCDMA is the same.

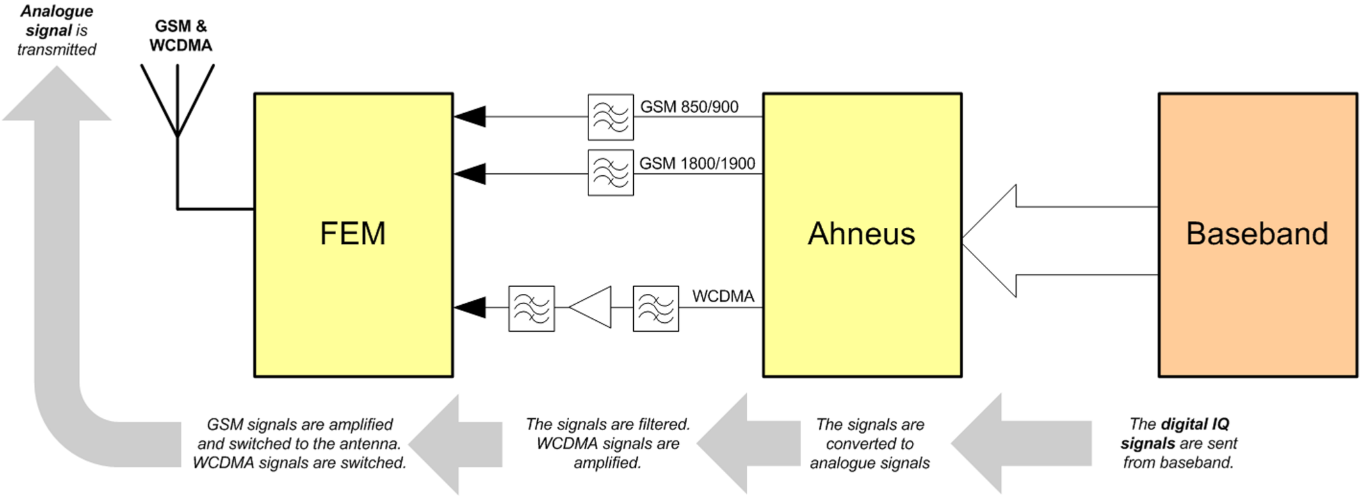

Analogue signal is received
GSM & WCDMA
FEM
GSM 850
GSM 900
GSM 1800
GSM 1900
WCDMA
Ahneus
Baseband
Antenna switch module selects correct path for network band in use.
The signal is filtered
The signal is converted to baseband I and Q signals.
The **digital signals** are sent on to the baseband module.

Transmitter (TX)

The digital baseband signal (eg. from the microphone) is converted to an analogue signal, which is then amplified and transmitted from the antenna. The frequency of this signal can be tuned to match the bandwith of the system in use (eg. GSM900).

The transmitter functions are implemented in the RF ASIC.

Even though the GSM and WCDMA signals are sent via different components, the principles of the transmission is the same.


Analogue signal is transmitted
GSM & WCDMA
FEM
GSM 850/900
GSM 1800/1900
WCDMA
Ahneus
Baseband
GSM signals are amplified and switched to the antenna. WCDMA signals are switched.
The signals are filtered. WCDMA signals are amplified.
The signals are converted to analogue signals
The **digital IQ signals** are sent from baseband.

Bluetooth

Bluetooth provides a fully digital link for communication between a master unit (the phone) and one or more slave units (e.g. a wireless headset). Data and control interface for a low power RF module is provided by the module.

The Bluetooth is physically integrated with the FM radio into one single module. From a functional point of view they, however, have nothing in common.

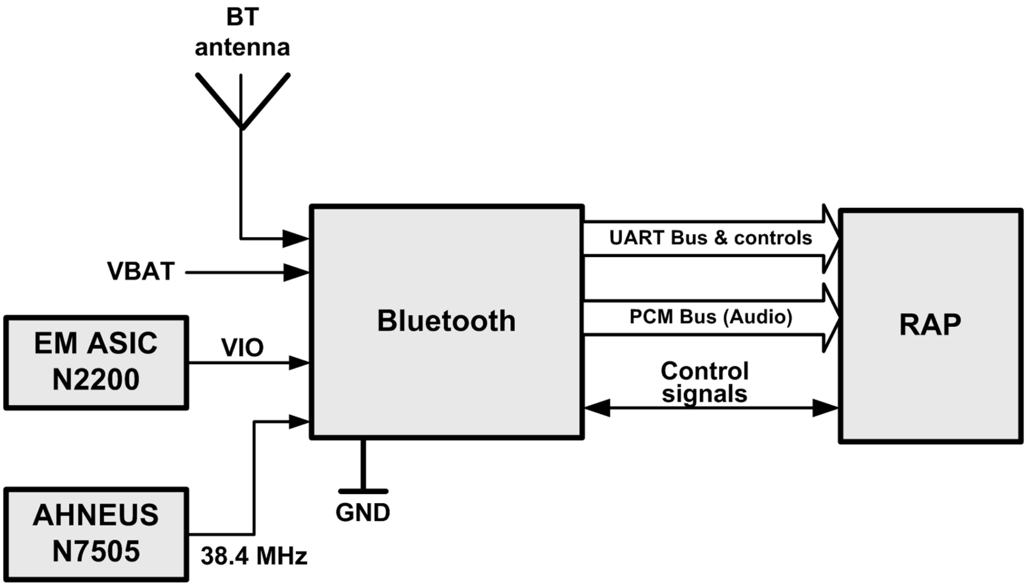

BT
antenna
VBAT
EM ASIC
N2200
VIO
AHNEUS
N7505
38.4 MHz
Bluetooth
GND
UART Bus & controls
PCM Bus (Audio)
Control
signals
RAP

Figure 34 Bluetooth interface

The Bluetooth has a separate built in antenna and is powered by VBAT and the regulated voltage VIO. For audio applications the Bluetooth has a PCM data bus. In addition a UART (universal asynchronous receiver/transmitter) is used for data communication and controls.

FM radio

The FM radio is physically integrated with the Bluetooth into one single module. From a functional point of view they, however, have nothing in common.

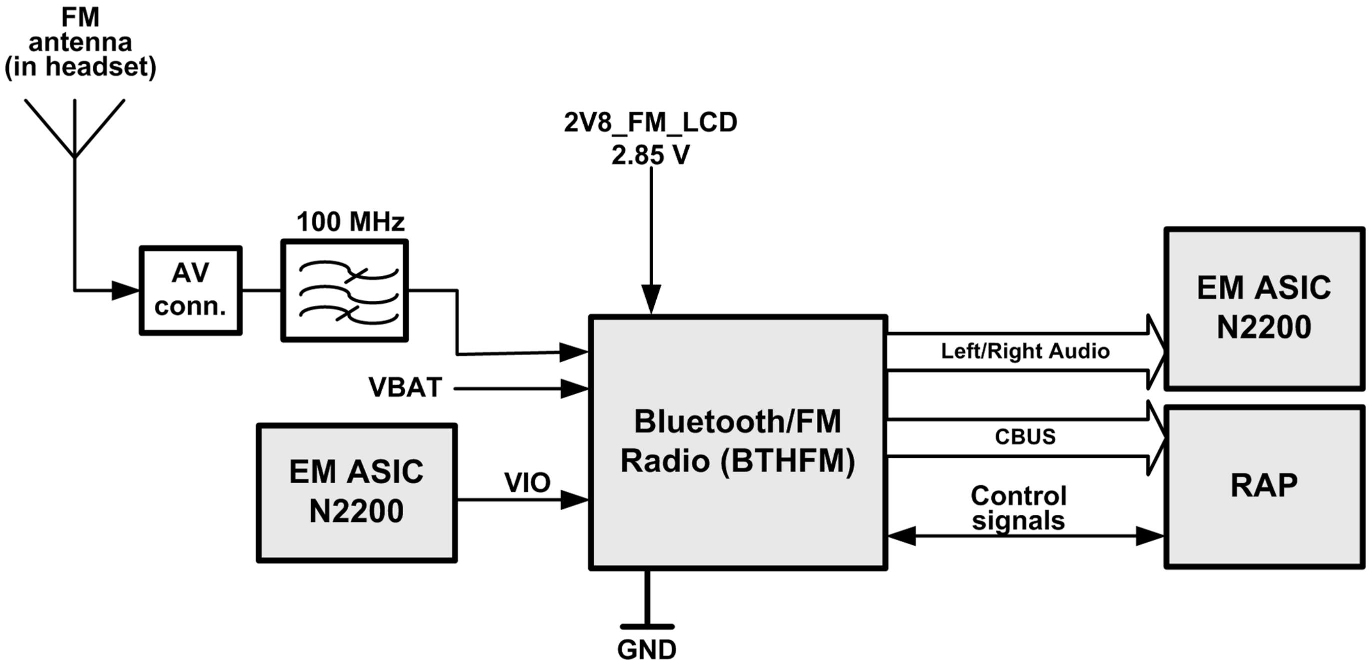

FM
antenna
(in headset)
AV
conn.
100 MHz
2V8_FM_LCD
2.85 V
VBAT
EM ASIC
N2200
VIO
Bluetooth/FM
Radio (BTHFM)
GND
Left/Right Audio
CBUS
Control
signals
EM ASIC
N2200
RAP

Figure 35 FM interface

The FM radio is an integrated circuit, controlled by MCU software through a serial bus interface. The wires of the headset are used as poles of the antenna, and no other antenna is needed for FM radio reception.

In addition to the Bluetooth unit the FM radio is provided with LDO (low drop out) voltage 2V8_FM_LCD.

The radio has an automatic band search function, which can search for a strong write/read signal from a certain frequency. When this is found, data is transmitted to the radio. When the signal strength is low, the EM ASIC N2200 (AVILMA) can read data, which is available until the signal is strong again.

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Glossary

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A/D-converter	Analogue-to-digital converter
ACI	Accessory Control Interface
ADC	Analogue-to-digital converter
ADSP	Application DPS (expected to run high level tasks)
AGC	Automatic gain control (maintains volume)
ALS	Ambient light sensor
AMSL	After Market Service Leader
ARM	Advanced RISC Machines
ARPU	Average revenue per user (per month or per year)
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BA	Board Assembly
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic (type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2, UEME and Zocus
CCP	Compact Camera Port
CDMA	Code division multiple access
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSD	Circuit-switched data
CSR	Cambridge silicon radio
CSTN	Colour Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analogue converter
DAC	Digital-to-analogue converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo

DCT-4	Digital Core Technology
DMA	Direct memory access
DP	Data Package
DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DTM	Dual Transfer Mode
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evolution
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GMSK	Gaussian Minimum Shift Keying
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HSDPA	High-speed downlink packet access
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity
IR	Infrared

IrDA	Infrared Data Association
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out
LED	Light-emitting diode
LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
MTP	Multipoint-to-point connection
NFC	Near field communication
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architecture
OMAP	Operations, maintenance, and administration part
Opamp	Operational Amplifier
PA	Power amplifier
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x and BB5
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board
PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RF	Radio Frequency

RF PopPort™	Reduced function PopPort™ interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multimedia Card
RSS	Web content Syndication Format
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)
RX	Radio Receiver
SARAM	Single Access RAM
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noise ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCP/IP	Transmission control protocol/Internet protocol
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPnP	Universal Plug and Play
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC
USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator

VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
VF	View Finder
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WCDMA	Wideband code division multiple access
WD	Watchdog
WLAN	Wireless local area network
XHTML	Extensible hypertext markup language
Zocus	Current sensor (used to monitor the current flow to and from the battery)

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